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BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY

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THE SOUTH MAGNETIC POLE*

The Magnetic Inclination and Declination in the Approaches to It, as Deduced from Observations Made in 1840 by the United States Expedition Commanded by Lieut. Charles Wilkes, U.S.N.

BY

G. W. LITTLEHALES

The Congress of the United States, having in view the extension of the empire of commerce and science, by an Act of the 14th of May, 1836, authorized an expedition to be fitted out for the purpose of exploring and surveying in the Pacific Ocean and the South Seas; and on the 10th of August, 1838, the sloops-of-war *Vincennes* and *Peacock*, the ship *Relief*, the brig *Porpoise*, and the tenders *Sea Gull* and *Flying Fish*, composing the squadron of the Exploring Expedition, set sail from Norfolk under the command of Lieut. Charles Wilkes, U.S.N.

It was the first of the great undertakings in which the national munificence was employed in the cause of exploration at sea, and, although its fundamental purposes were to promote commerce and navigation, to diminish the hazards of the ocean, and to point out to future navigators a course by which they might avoid dangers and find safety, one of the primary aims was also to extend the bounds of science and promote the acquisition of knowledge.

An abundant instrumental equipment was procured from the best English, French and German makers, and a corps of scientists accompanied the expedition for the more successful attainment of its purposes.

The world has long known and benefited by the results of the

* Map facing p. 80.

labors of this Expedition in hydrography and geography, in astronomy and meteorology, in botany and horticulture, in philology, geology and biology. This will appear from the array of resulting scientific volumes for which the country is particularly indebted to the Joint Committees on Library of the Twenty-seventh and Twenty-eighth Congresses, to whose supervision the execution of the provisions for the publication of these works was entrusted.

Senate Report No. 391 of the Thirty-fifth Congress, 2nd session, sets forth that the plan of the work embraced twenty-four volumes and fourteen atlases, and that, on March 3, 1859, there had been published:

The narrative of the Expedition, in five volumes with atlas; Philology (vol. 6), Zoophytes (vol. 7), with atlas; Ornithology and Mammalogy (vol. 8), with atlas ; Races of Men (vol. 9), Geology (vol. 10), with atlas; Meteorology (vol. 11), Mollusca (vol 12), with atlas; Crustacea (vols. 13 and 14), with two atlases; Botany (vol. 15), with atlas; Ferns (vol. 16), with atlas, and Herpetology (vol. 20), with atlas; further, there were nearly printed for publication: Botany, by Torrey (vol. 17), with atlas; Botany, by Gray (vol. 18), with atlas, and Hydrography (vol. 23), with two atlases; that the manuscript of the Geographical Distribution of Plants by Pickering (vol. 19) was complete; that the manuscripts of Ichthyology by Agassiz (vols. 21 and 22), with two atlases, were nearly ready, and that the volume on Physics (No. 24) was in progress.

Volumes 17 and 23 treating of Botany and Hydrography were subsequently published, but the printing of volumes 18, 19, 21 and 22 was never completed; and, when in 1876, Congress postponed indefinitely further steps in the publication, as shown by Senate Report No. 60, 44th Congress, 1st session, the contemplated volume on Physics does not appear to have emerged from the manuscript stage.

These unpublished observations, and the results which should have been derived from them, have thus far been lost to the world, and the Expedition worked in vain as far as any benefit has yet been derived from the pendulum, tidal, magnetic, and other physical results that were intended to be discussed and included in the volume on Physics.

The searches of thirty years did not reveal any trace of the manuscript records of these observations until fragments were recently found among the household papers of the descendants of Admiral Wilkes. Although they had been subjected to many

vicissitudes in their removal from place to place with the family effects, it was possible, through the gracious kindness of the Misses Wilkes, to extract from them the material for a complete representation of the lines of magnetic inclination and declination in the approaches to the South Magnetic Pole and along the borders of the Antarctic Continent, from the facts of observation as recorded by observers equipped with magnetic instruments of the highest order of excellence, on board the four ships of that part of the Expedition which penetrated the Antarctic region.

The results of the discussion of the recovered observations have yielded the accompanying map, which shows, in addition to the lines of the variation of the compass or magnetic declination and the lines of dip or magnetic inclination for the epoch 1840, the edge of the icy barrier bordering the continent as plotted by the Americans. Such magnetic lines from original observations made long ago have a value which increases with the lapse of years on account of their importance in elucidating the changes which time works in altering the magnetic state of the earth.

Value would not attach to the recovery of the tidal observations and the records of the pendulum experiments in the same degree as to the magnetic observations, because, as the tides and the force of gravity in a given locality do not appear to change with the course of time, the loss of the records in relation to them might be made good by taking observations at any subsequent period at the same stations.

But it is not so with the elements of the earth's magnetism. The observations of them yields the record of a fleeting condition to which we can never reascend until the laws of their age-long changes come to be understood.

It will be remembered that, during the year 1839, after having examined many of the island groups with which the vast area of the Pacific Ocean is studded, the Exploring Expedition had reached the Australian shores. On the day after Christmas in 1839, the *Vincennes*, *Peacock*, *Porpoise* and *Flying Fish* headed southward from Sydney, and, falling in with the land in latitude 64° south and longitude 158° east of Greenwich, on the 16th of January following, skirted the border of a new continent to the eastward as far as longitude 97° east of Greenwich. Returning to Sydney, Wilkes announced his discovery in the following words, in a report to the Secretary of the Navy, dated March 11, 1840:

"It affords me much gratification to report that we have discovered a large body of land within the Antarctic Circle, which I

have named the Antarctic Continent, and refer you to the report of our cruise and accompanying charts, enclosed herewith, for full information relative thereto."

During the cruise, in the opening months of 1840, the observations were taken which are now brought forward for discussion:

TAKEN ON BOARD THE SHIP VINCENNES

Date 1840.	Latitude South.	Longitude East.	Declination.	Inclination.	Needle.	Reference.
Jan. 11	63°–32′	164°–55′	23°–04′ E.	81°–24′–32″ S.	Gambey (.)	V. 1
				81 –11 –15	" (. .)	
Jan. 18	66 –08	154 –53	20 –00 E.	86 –28 –19	" (.)	V. 2
				86 –21 –00	" (. .)	
				83 –16 –30	" (.)	
				83 –08 –37	" (. .)	
Jan. 23	66 –47	148 –10	19 –06 E.	87 –42 –45	" (.)	V. 3
				87 –38 –15	" (. .)	
Jan. 25	67 –04	147 –30	11 –46 E.	87 –16 –15	" (.)	V. 4
				87 –12 –46	" (. .)	
Feb. 1	66 –15	138 –00	2 –30 W.	85 –30 –15	" (.)	V. 5
				85 –16 –05	" (. .)	
Feb. 7	64 –30	131 –30	7 –08 W.	84 –07 –30	" (.)	V. 6
				84 –09 –56	" (. .)	
Feb. 12	65 –10	112 –00	49 –30 W.	82 –20 –37	" (.)	V. 7
				81 –59 –03	" (. .)	
Feb. 14	66 –00	106 –14	59 –31 W.	82 –41 –15	" (.)	V. 8
				82 –15 –37	" (. .)	
Feb. 17	64 –00	97 –04	54 –39 W.	79 –09 –45	" (.)	V. 9
				80 –14 –00	" (. .)	

TAKEN ON BOARD THE BRIG PORPOISE

Date 1840.	Latitude South.	Longitude East.	Declination.	Inclination.	Needle.		Reference.
Jan. 9	58°–30′	163°–30′	21°–00′ E.	77°–42′.45 S.	Lloyd	1	P. 1
				78 –18 .75	"	2	
Jan. 11	64 –20	164 –20	25 –35 E.	82 –25 .00	"	1	P. 2
				82 –43 .75	"	2	
Jan. 12	64 –35	165 –40	27 –20 E.	82 –01 .80	"	1	P. 3
				82 –41 .25	"	2	
Jan. 13	65 –08	163 –51	30 –27 E.	83 –26 .25	"	1	P. 4
				82 –48 .45	"	2	
Jan. 15	66 –08	158 –20	32 –04 E.	83 –56 .25	"	1	P. 5
				83 –30 .00	"	2	
Jan. 17	66 –20	157 –00	26 –17 E.	84 –11 .25	"	1	P. 6
				84 –15 .00	"	2	
Jan. 22	66 –30	151 –40	22 –08 E.	85 –30 .00	"	1	P. 7
				85 –35 .62	"	2	
Jan. 23	66 –50	151 –25	21 –04 E.	85 –43 .12	"	1	P. 8
				85 –41 .25	"	2	
Feb. 1	64 –40	131 –00	9 –33 W.	85 –18 .75	"	1	P. 9
				85 –22 .50	"	2	
Feb. 9	64 –50	111 –00	46 –49 W.	83 –33 .75	"	1	P. 10
				83 –18 .75	"	2	
Feb. 11	65 –35	106 –00	53 –16 W.	82 –22 .30	"	1	P. 11
				82 –03 .52	"	2	
Feb. 13	64 –40	102 –00	55 –10 W.	81 –00 .00	"	1	P. 12
				81 –00 .00	"	2	

TAKEN ON BOARD THE SHIP PEACOCK

Date 1840.	Latitude South.	Longitude East.	Declination.	Inclination.	Needle.	Reference.
Jan. 23	66°–52′	150°–24′–45″	15°–00′ E.	86°–10′	Robinson	H.
				86°–23′	Lloyd	

In consequence of the very near approach to the magnetic pole which the great amount of dip indicates, and the consequent curvature of the lines of equal dip, the observations are to be treated by gathering them together into groups so circumscribed that within the limits of each no important error could arise in considering the isoclinal line to coincide with its tangent. On inspecting the observations with this purpose, it was seen that, by leaving out of view the observations P. 1 and V. 9, the remainder might be arranged in four groups, each comprised within less than ten degrees of longitude, and of which the whole would be included within less than four degrees of latitude. Adopting this method, taking the mean of the readings of the needles of each set, and reducing the minutes to decimals of a degree, the arrangement of the groups is as follows:

GROUP A.

Reference.	Latitude.	Longitude.	Dip.
P. 3	64°–35′	165°–40′	82°.359
V. 1	63 –32	164 –55	81 .298
P. 2	64 –20	164 –20	82 .573
P. 4	65 –08	163 –51	83 .122
P. 5	66 –08	158 –20	83 .719
P. 6	66 –20	157 –00	84 .219

GROUP B.

Reference.	Latitude.	Longitude.	Dip.
V. 2	66°–08′	154°–53′	84°.810
P. 7	66 –30	151 –40	85 .547
P. 8	66 –50	151 –25	85 .705
H.	66 –52	150 –24 45″	86 .275
V. 3	66 –47	148 –10	87 .675
V. 4	67 –04	147 –30	87 .241

GROUP C.

Reference.	Latitude.	Longitude.	Dip.
V. 5	66 –15	138 –00	85 .386
V. 6	64 –30	131 –30	84 .145
P. 9	64 –40	131 –00	85 .344

GROUP D.

Reference.	Latitude.	Longitude.	Dip.
V. 7	65 –10	112 –00	82 .164
P. 10	64 –50	111 –00	83 .437
V. 8	66 –00	106 –14	82 .474
P. 11	65 –35	106 –00	82 .215
P. 12	64 –40	102 –00	81 .000

On examining group C, it is obvious by mere inspection that the observations P. 9, made on board the *Porpoise*, does not correspond with the other two, made on board the *Vincennes*. On trial it was found that the combination of these three would indicate a decrease of inclination with an increase of latitude, which is contradicted by all the other observations. As the probabilities appear to be in favor of the accuracy of the observations made on the *Vincennes*, the observation of the *Porpoise* has been rejected in the treatment of this group.

In group A, if we take as a central position a point in latitude 65°–30′ South and longitude 161°–30′ East, we have for the geographical co-ordinates of the places of observation:

Place.	Difference of Latitude.	Difference of Longitude.	
P. 3......	— 55′	+4°.10 =	+107.2995 geographical miles.
V. 1......	—118	+3 .25 =	+ 91.3638 " "
P. 2......	— 70	+2 .50 =	+ 73.6329 " "
P. 4......	— 22	+2 .21 =	+ 59.2916 " "
P. 5......	+ 38	—3 .10 =	— 67.8758 " "
P. 6......	+ 50	—4 .30 =	—108.3821 " "

Let. d = the difference between 81° and the dip or inclination at the central position.

" y = the increase of dip for each minute of latitude in fractions of a degree.

" x = the increase of dip for each geographical mile of longitude in fractions of a degree.

Then the following equations of condition may be formed:

$$
\begin{aligned}
-1.359 &= d + 107.2995\,x - 55\,y \\
-0.298 &= d + 91.3698\,x - 118\,y \\
-1.573 &= d + 73.6329\,x - 70\,y \\
-2.122 &= d + 59.2916\,x - 22\,y \\
-2.719 &= d - 67{,}8578\,x + 38\,y \\
-3.219 &= d - 108.3821\,x + 50\,y
\end{aligned}
$$

Forming normal equations from these by the method of least squares, and solving for d, x, and y, we obtain:

d= —2°.353958, and the dip at the central station = 83°.353958
x= —0°.000795
y= —0°.016706

For the angle u, which the isoclinal line makes with the meridian, we have

$$\tan u = \frac{y}{x}$$

Whence u = + 87°–16′–32″.

Making the direction of the isoclinal line from N. 87°–16′–32″ E. to S. 87°–16′–32″ W.

Calculating the dips at the several stations from the above results, we obtain the following differences between the calculated and observed dips:

PLACE.	DIFFERENCE.
P. 3	—0°.161431
V. 1	—0°.157284
P. 2	+0°.329924
P. 4	+0°.088437
P. 5	+0°.215825
P. 6	+0°.115906

In group B, if we take as a central position a point in latitude 66°–30′ south and longitude 151° east, we have for the co-ordinates of the places of observation:

Place.	Difference of Latitude.	Difference of Longitude in Geographical Miles.
V. 2	—22′	+94.2740
P. 7	0	+15.9500
P. 8	+20	+ 9.8352
H.	+22	—13.8487
V. 3	+17	—67.0156
V. 4	+34	—81.8236

Treating these in the manner just illustrated in relation to group A, we obtain

$d = -2.301293$, and the dip at the central position $86°.301293$
$x = +0.022106$
$y = +0.021807$
$u = +43°-38'-55''$

For the differences between the observed and calculated dips in this group, we have:

PLACE.	DIFFERENCE.
V. 2..........	+0.128814
P. 7..........	—0.401702
P. 8..........	+0.042864
H.	+0.131482
V. 3..........	+0.250739
V. 4..........	—0.152598

Of group C we retain only the observations designated V. 5 and V. 6. The calculations made from these give the following results for a central position in latitude 63°–30′ south and longitude 135° east.

$d = 0.854107$, and the dip at the central position $= 84°.854107$
$x = 0.000000$
$y = +0.011815$
$u = 90°$

whence the difference between the observed and calculated values of the dip become

—0.000180
+0.000207

In group D the following results were obtained for a central position in latitude 65° south and longitude 107° east.

$d = 1.1071529$, and the dip at the central position $= 82°.1071529$
$x = -0.0062103$
$y = +0.0054502$
$u = -41°-16'-13''$

The differences between the observed and calculated values of the dip are:

PLACE.	DIFFERENCE.
V. 7...... ..	—0.7801154
P. 10.........	+0.7505259
V. 8.........	+0.1560298
P. 11.........	+0.0711197
P. 12.........	—0.2058669

If we consider that the probable position of the south magnetic pole could be found by means of the intersection of the normals to the isoclinal lines, the groups B, C, and D would furnish a remarkable result. Upon a polar gnomonic projection the three direc-

tions converge almost to one point. The direction of the normal of group A will not, however, intersect that of B on the southern side of the isoclinal line.

The computed position of the magnetic pole, from a combination of groups B and C, was

Latitude 68°–56′–15″ south, Longitude 135° east;

and, from a combination of groups C and D,

Latitude 68°–42′–07″ south, Longitude 135° east.

The isoclinal lines would appear from inspection of the values of u, in the four separate groups to be curves of contrary flexure, changing the direction of their curvature between the groups A and C, and thence forming an oval, concave toward the south. Calculation further shows that the magnetic polar distances of the central points of the four groups A, B, C, and D are, respectively, 12°–48′–04″, 7°–22′–04″, 12°–38′–30″, and 15°–29′–56″, and the average of these would indicate that the magnetic pole was in latitude 77°–12′ south.

The highest dip observed by Wilkes was 87°–40′, and the compasses on the ice were very sluggish, pointing 19°–06′ east of the meridian as accurately as could be determined; this was in longitude 148°–10′ east and latitude 66°–47′ south.

The indications would point to the fact that the south magnetic pole was not then a mere point, but that there must have been a large irregular area over which the dipping needle stood vertical or very near vertical.

The observations for the variation of the compass or magnetic declination are so numerous that after plotting all of them the isogonic lines could be drawn very readily with the help of the variation lines laid down upon the chart of the Antarctic Continent in volume I of the Atlas of Charts accompanying the volume on Hydrography of the Exploring Expedition; and they are thus included in the accompanying map of Magnetic Declination and Inclination in the Approaches to the South Magnetic Pole.

THE HEART OF THE ANTARCTIC*

BY

EDWIN SWIFT BALCH

(Map facing p. 80)

In the annals of Polar discovery, no more brilliant exploit can be found than the Antarctic voyage of exploration under the command of Ernest H. Shackleton. Well conceived, well planned and well carried out, it has added to the realm of geography a vast amount of knowledge. The narrative of the journey is clear, accurate and temperate. The make-up of the book, paper, printing and illustrations, is a worthy setting for the narrative; altogether there can be nothing but praise for the efforts of the authors and the publishers.†

Shackleton was a member of Captain Scott's expedition in the *Discovery,* and in the year 1907, outlined a new expedition of his own. He succeeded in securing sufficient funds, principally through loans which he was to pay off on his return. It is pleasant to record that the British Government voted him £20,000 after his successful journey, a sum which enabled him to clear off all his debts. He was also knighted on King Edward's birthday, showing how England rewards its own Polar discoverers.

He purchased an old whaler, the *Nimrod,* which proved to be a fairly good boat. The expedition was carefully fitted out with food, clothing, general stores, and scientific instruments. A wooden hut was built and carried in pieces for re-erection in the Antarctic. A motor car, some dogs and Manchurian ponies were also taken along.

The shore party consisted of fifteen men:

Ernest Henry Shackleton, commander. Born 1874. Went to sea at the age of sixteen, became a lieutenant in the Royal Naval Reserve. In 1901, he joined the British National Antarctic expedition, and was a member of the "farthest south" party. Was defeated for Parliament in 1906.

J. B. Adams, lieutenant Royal Naval Reserve, meteorologist.

Bertram Armytage, in charge of ponies.

Sir Philip Brocklehurst, assistant geologist.

Professor T. W. Edgeworth David, F.R.S., geologist.

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* "The Heart of the Antarctic." Being the story of the British Antarctic Expedition, 1907–1909, by E. H. Shackleton, C.V.O. 2 vols. With an Introduction by Hugh Robert Mill, D.Sc. An Account of the First Journey to the South Magnetic Pole by Professor T. W. Edgeworth David, F.R.S. J. B. Lippincott Company, Philadelphia, 1909. $10.

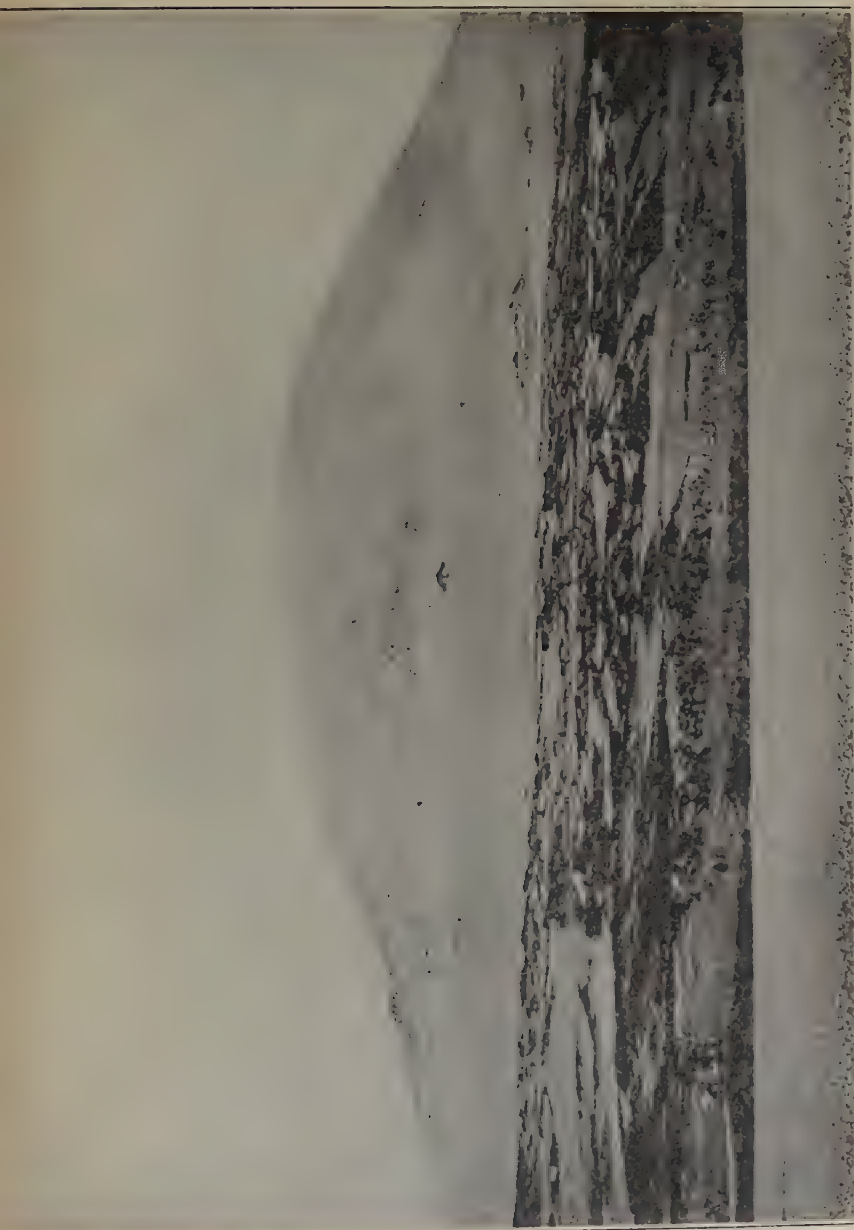
† The Society is indebted to the J. B. Lippincott Company for permission to use the photographic illustrations reproduced here from Shackleton's book.

Bernard Day, electrician and motor expert.
Ernest Joyce, in charge of stores, dogs, sledges and zoological collections.
Dr. A. F. Mackay, surgeon.
Dr. Eric Marshall, surgeon and cartographer.
Douglas Mawson, mineralogist.
James Murray, biologist.
Raymond Priestley, geologist.
William Roberts, cook.
Frank Wild, in charge of provisions.

The *Nimrod* left Lyttelton, New Zealand, on Jan. 1, 1908. She was towed by the *Koonya* as far as the ice, following in the main the 180th meridian. Some heavy weather was encountered, the waves being estimated as rising to as much as 42 feet in height. Pushing down Ross Sea, the *Nimrod* reached the Great Ice Barrier on Jan. 23, in about 172° West. She followed the Barrier eastward, to nearly 162° West, when steep and rounded cliffs and sharp peaks, rising to a height of approximately 800 feet, were seen behind the ice. This is possibly new land, which was not noticed by Sir James C. Ross or Captain Scott. The ice beyond this point was so thick that further progress was impossible, and thus Shackleton was prevented from wintering on King Edward Land, as he had originally intended. He therefore turned the *Nimrod's* prow west and sailed to McMurdo Sound, which he reached on Jan. 29. During Feb., stores and equipment were landed and the hut was set up at Cape Royds, Ross Island, and on Feb. 22, the *Nimrod* sailed for New Zealand.

The first of the three important land journeys carried out by Shackleton's expedition, the ascent of the volcano Erebus, was undertaken almost immediately. On March 5, 1908, a party of six, Adams, Brocklehurst, David, Mackay, Marshall and Mawson, started from Cape Royds, and carried out successfully this difficult ascent. There was only one mishap, namely that Brocklehurst's feet were badly frost-bitten, necessitating, later, amputation of one of his big toes. The party reached the summit, 13,370 feet, on March 10, and returned to Cape Royds a couple of days later.

The crater was found to be about 900 feet deep and half a mile wide, and every little while great masses of steam would rush upwards with a loud hissing sound. The most unique feature was the ice fumaroles, of which about fifty were seen. These are ice mounds, resulting from the condensation of vapors around the orifices of ordinary volcanic fumaroles, forming ice structures unknown in any other place in the world, and which could only exist under conditons of very low temperatures.



MOUNT EREBUS AS SEEN FROM WINTER QUARTERS.

Old crater on the left, and active cone rising on the right.

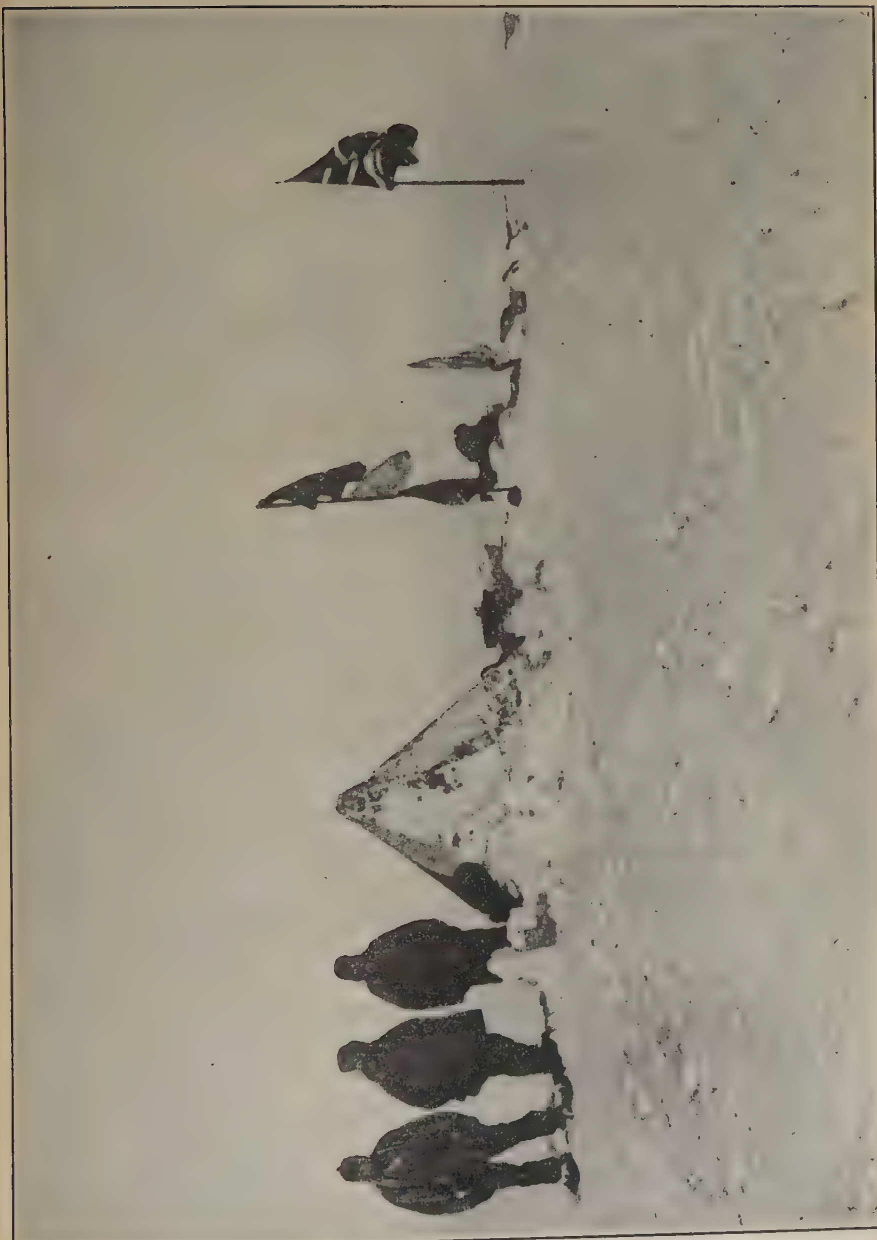
Erebus was steep and icy from bottom to top, the temperature sometimes fell below zero, and there were snow storms and blizzards. Altogether this ascent, by far the highest yet accomplished in Antarctica, must rank among the most difficult of mountain climbs yet made. Erebus is a magnificent mountain. It was watched all through the winter, and every now and then, sometimes at intervals of a quarter of an hour, a strong glow was seen on top. Sometimes great bursts of flame were seen crowning the crater. The column of steam that rises from the crater sometimes rose 3,000 or 4,000 feet before it spread out and was blown horizontally by the upper air currents. The deep red glow occasionally seen on the steam cloud revealed the presence of molten lava in the crater. Altogether there are proofs sufficient to show that Erebus possesses considerable volcanic activity.

The winter was spent in the usual polar manner, taking observations, preparing for sledge journeys, and inventing amusements, such as printing a small book, to pass the time. In September, a preliminary voyage was made to the south, to place depots of stores on the Ice Barrier.

The southern party, consisting of Shackleton, Adams, Marshall and Wild, left the winter quarters on October 29, 1908. They travelled almost due south, at first on the Great Ice Barrier. On this, both going and coming back, they had some trouble with crevasses. On Nov. 26, 1908, they reached 82° 18′ South Lat., just beyond Scott's farthest southern point. New mountain ranges, the continuation of Victoria Land, now began to appear, extending in a south-southeast direction and thereby gradually crossing the direct route to the South Pole. The party kept travelling on the Barrier until Dec. 2, when they were in latitude 83° 28′ S., where the mountains fairly blocked the way directly south.

Here an enormous glacier, stretching almost due south, flanked by huge mountains, and throwing its ice out on the Barrier, fortunately afforded a sort of portal by which the ice cap above could be reached. Up this glacier, afterwards called the Beardmore Glacier, the southern party now forced their way, making one of the most remarkable ascents in the history of mountaineering. Difficulties began at once. Snow slopes changed into blue ice, with numberless crevasses, many of them razor-edged. At 83° 40′ S., a bird, of a brown color, with a white line under each wing, flew past in a southern course. It was not a skua gull. This was the furthest point at which any living thing was seen.

On Dec. 7, they traversed some exceedingly crevassed ice.



THE FURTHEST SOUTH CAMP AFTER SIXTY HOURS' BLIZZARD.

Shackleton, Adams and Marshall were pulling one sledge, and Wild was leading the only remaining pony drawing the other sledge. The first party passed over a hidden crevasse without noticing it, but the greater weight of the pony broke the lid. The pony was swallowed up in the depths of the ice, but fortunately the swingletree snapped, and Wild and the sledge were saved. This was at an altitude of 1,750 feet.

Steady progress was made up the glacier, in spite of the constant danger from crevasses, and the improper foot gear of the party. They were wearing fur boots without spikes. So far nothing has been suggested in the way of suitable boots for mountain climbing in exceedingly low temperatures. The need of some boot in which there are spikes, placed so as not to transmit cold to the feet, has been noticed in the Himalaya and the Antarctic, and there is an opportunity for some inventive genius to devise some new foot covering for use on the highest mountains and in the South Polar regions.

In latitude 85° S., Wild found some seams of coal from 4 inches to 8 feet in thickness, with sandstone intervening. On Christmas day the party were in latitude 85° 55′ S. The glacier proved to be about 130 miles in length, and its top was fairly reached on Dec. 31, at an altitude of 10,477 feet, when the party at last stood on the great ice cap of East Antarctica. The plateau rose gently, however, and on Jan. 3, 1909, they were at an altitude of 11,220 feet.

Food was getting short and rations were steadily cut down. Terrific blizzards swept over the ice cap, the wind sometimes howling along at 80 or 90 miles an hour. The thermometer recorded from 60° to 70° of frost, and on several occasions, the party could do nothing but lie in their bags and let the storm rage past them. Nevertheless these gallant men steadily pushed south.

On Jan. 9, 1909, Shackleton reached his extreme southern point, in latitude 88° 23′ S., longitude 162° E., at an altitude of about 11,600 feet. Here they looked south with powerful glasses, but could see nothing but the dead white snow plain. There was no break in the plateau as it extended toward the Pole, and there can be scarcely a doubt that the South Pole lies in this stupendous plain of ice. Shackleton then hoisted Queen Alexandra's flag, and took possession of the ice in the name of King Edward VII.

The return journey was made almost exactly in the tracks of the outgoing journey, and the food depots were fortunately picked up one by one. It was a long retreat with starvation stalking on their heels. In almost every case they reached each depot with their food

bags empty, and it seems almost a miracle that they ever returned at all. After leaving the plateau, they descended the Beardmore Glacier to the Ice Barrier, which they followed to the winter quarters on March 1, where they found the *Nimrod* awaiting them.

The latitude observations on the southern journey were taken with a theodolite, the last one being made in 87° 27′ south. The important results of the journey are the discovery of the mountain chain stretching beyond Mount Longstaff towards Alexander Land; the fact that the ice cap of East Antarctica almost surely stretches to the South Pole and probably far beyond it; and the discovery of coal and fossil wood, which sheds some light on the past geological history of the continent of Antarctica.

Simultaneously with Shackleton's southern trip, a journey was made to the north by David, Mackay, and Mawson, on which the South Magnetic Pole was reached. They left Cape Royds on Oct. 5, 1908, and travelled north on the sea ice along the coast as far as the Drygalski Glacier, in about 75° 30′ S. L., which they reached on Nov. 30. The party had neither dogs nor ponies, and so had to drag their two sledges and cover each piece of ground, or rather sea ice, three times. Up to this point they had no particular trouble, although they soon discovered that if they were to reach the South Magnetic Pole, they would have to travel on short rations.

During the next four weeks, the northern party was busy crossing the Drygalski Glacier, and ascending one of its feeders, the Larsen Glacier, to the ice cap of East Antarctica. They only gained 20 miles in these efforts, encountering great difficulties from steep ice ridges and crevasses, and twice failing in attempts to climb to the plateau, first by the Mount Nansen Glacier and then by the Bellingshausen Glacier. By the end of December, they were fairly through the coastal range, and began to ascend the ice cap.

The party now made a bee line across the ice cap to the South Magnetic Pole. The ice cap rose slowly, from an altitude of 2,800 feet at the head of the Larsen Glacier, to an altitude of 7,350 feet. Soft snow in places, and many sastrugi gave a good deal of trouble, and some blizzards interfered with the travellers. On the whole, however, they made rapid progress, and on Jan. 16, 1909, they reached the South Magnetic Pole, in 72° 25′ S. L., 155° 16′ E. L. As they were only able to stay there a few hours, sufficient observations could not be taken to say that this position is more than approximately correct. They took possession of the South Magnetic Pole for the British Empire, and it may be noted in this connection that the South Magnetic Pole lies almost due south of Wilkes' Cape Hudson.

On Jan. 17, they started back to the coast, following their up tracks. In some places, they put crampons over their finnesko and found them of decided use. The food was running short and sometimes there was trouble with crevasses, but on the whole, they returned with ease, and reached the ocean at Drygalski Glacier on Feb. 3. By great good fortune, the *Nimrod,* which was searching along the coast for the Magnetic Pole party, reached the spot the next day and sighted the explorers' tent. A gun was fired, whereupon the explorers rushed down to meet the ship, and in so doing, Mawson disappeared twenty feet deep into a crevasse and was nearly lost. They were then taken aboard, and the *Nimrod* sailed to Cape Royds to pick up the southern party.

The geographical results of this journey are important. Mawson triangulated the coast of Victoria Land from McMurdo Sound to Drygalski Glacier, and many new peaks, glaciers, ice tongues, and two small islands were discovered. The position reached at the South Magnetic Pole, south latitude 72° 25′, east longitude 155° 16′, shows that the ice cap extends due south of Cape Hudson, and the altitude at the Magnetic Pole, 7,260 feet, implies that the northern coast must be several degrees to the north, almost to a certainty where Admiral Wilkes charted it in 1840.

A journey up the Ferrar Glacier was made from the winter quarters, by Armytage, Brocklehurst and Priestley, between Dec. 9, 1908, and Jan. 25, 1909. On their return, they encamped one night on the sea ice in McMurdo Sound. This broke off from the shore, and they drifted out to sea. Killer whales were spouting around them and occasionally bumping the floe beneath the explorers. By good luck, the wind changed and drifted the explorers back to the shore, on which they were able to jump and thus save themselves from a watery grave.

On March 4, 1909, the *Nimrod* sailed for the north, with all the members of the expedition aboard. They sailed past Cape Adare and to Cape North, where Shackleton wanted to try to push to the westward. The ice, which appears always to be very heavy in this locality, prevented his doing so, but about 45 miles of new coast line, running first south, then west, were visible. Thence the *Nimrod* returned to New Zealand, and afterwards to England, searching, on her home voyage, for Emerald Island, the Nimrod Islands, and Dougherty Island, none of which was found.

Several points, connected with the expedition as a whole, are of interest and of some novelty.

One is the question of clothing. Some Antarctic expeditions,

REMARKABLE FUMAROLE IN THE OLD CRATER IN THE FORM OF A COUCHANT LION,

notably those of Bruce, Nordenskjöld, Scott, and Charcot, largely abandoned the use of fur garments in the Antarctic, preferring woolen clothing with canvas overalls. Shackleton developed this method of dress to the utmost, using furs only for sleeping bags, shoes and mits. His party had pilot cloth coats and trousers, but eventually even these were almost wholly given up. The sledging parties usually wore two or more sets of various sorts of Jaeger woolen undergarments, over which was placed a suit of windproof Burberry canvas. These garments were extremely light in weight and this conduced materially to the speed of travel. To some extent, however, it also conduced to frostbite. Nevertheless Shackleton's verdict is "that men engaged in polar exploration should be clothed as lightly as possible, even if there is danger of frostbite when they halt on the march."

The health of the party was remarkably good throughout the entire expedition. They apparently suffered most from cases of frost-bite when sledging, and this might be used as an argument that the light woolen clothes, with an outer canvas covering, are not those best suited for Polar work. On the southern journey, the party suffered to some extent from dysentery, and this was attributed to eating the meat from one of the ponies, which was shot one night when in a greatly exhausted condition. It seems probable that his flesh was made poisonous by the toxin of exhaustion, which is said to be the case sometimes with animals that have been hunted. The disease called "colds," as is well known, practically owing to the absence of germs, is never experienced in the Polar regions. Shackleton's party, however, had a few colds, and it was thought they were due to germs contained in a bale of blankets.

It is a fact well known to Polar travellers that the main subject of conversation when sledging is food. Shackleton's and David's parties were no exception to this axiom. Both their diaries give abundant proof of it. Shackleton writes: "Feb. 9: All thinking and talking of food." "Feb. 10: All thinking and talking of food." "Feb. 11: All our thoughts are of food," etc., etc. No one, however, has yet described any of these conversations as well as Shackleton has in one passage which deserves to be quoted at length:

> "Now we are on board ship," one man would say. "We wake up in a bunk, and the first thing we do is to stretch out our hands to the side of the bunk and get some chocolate, some Garibaldi biscuits and some apples. We eat those in the bunk and then we get up for breakfast. Breakfast will be at 8 o'clock, and we will have porridge, fish, bacon and eggs, cold ham, plum pudding, sweets, fresh roll and butter, marmalade and coffee. At 11 o'clock we will have hot cocoa, open jam tarts, fried cod's roe and slices of heavy plum cake. That will be all

until lunch at 1 o'clock. For lunch we will have Wild roll, shepheard's pie, fresh soda-bread, hot milk, treacle pudding, nuts, raisins and cake. After that we will turn in for a sleep, and we will be called at 3.45, when we will reach out again from the bunks and have doughnuts and sweets. We will get up then and have big cups of hot tea and fresh cake and chocolate creams. Dinner will be at 6, and we will have thick soup, roast beef and Yorkshire pudding, cauliflower, peas, asparagus, plum pudding, fruit, apple-pie with thick cream, scones and butter, port wine, nuts, and almonds and raisins. Then at midnight we will have a really big meal, just before we go to bed. There will be melon, grilled trout and butter-sauce, roast chicken with plenty of livers, a proper salad with eggs and very thick dressing, green peas and new potatoes, a saddle of mutton, fried suet pudding, peaches à la Melba, egg curry, plum pudding and sauce, Welsh rarebit, Queen's pudding, angels on horseback, cream cheese and celery, fruits, nuts, port wine, milk and cocoa. Then we will go to bed and sleep till breakfast time. We will have chocolate and biscuits under our pillows, and if we want anything to eat during the night we will just have to get it."

Probably no one has ever described so well as yet the talk of men on the verge of absolute starvation.

The Manchurian ponies which Shackleton took along proved most valuable as transport animals, probably better than dogs. They would have been even more so, had it not been for their habits of feeding, which resulted in the death of half of them, before they had been of any use. They were fond of eating bits of rope, the tails of the other ponies, in fact anything they could chew or swallow. When first landed, they ate quantities of the volcanic sand of the sea shore, perhaps because it had a saline taste due to the fact that the blizzards sprayed all the land near the shore with sea water. Three of them died from this cause, which could not be explained until a post mortem examination of one of the ponies revealed the fact that his stomach contained many pounds of sand.

Shackleton makes a brief but valuable statement in regard to a matter of much importance in the history of Antarctic discovery. A party one day started off across the ice to visit Inaccessible Island. It proved a much longer jaunt than was expected and Shackleton says that before they returned "they had learned the first lesson of the Antarctic, which is, that distances are very deceptive, and that land is always much more distant than it appears to be."

The scientific and geographic results of the expedition were numerous and valuable.

An important discovery in biology was that made by Murray, on March 13, 1908, that there were living microscopical animals in the fresh water lakes of Antarctica. He obtained gradually a number of these, principally of the varieties known as rotifers and water

bears. They were generally found adhering to small weeds and plants on which they fed. Experiments were tried, which proved that freezing them at the lowest attainable temperatures, did not in the least affect their vitality. Only by subjecting them to tests in liquid air, would it be possible to ascertain what temperature would kill them: in the lowest Antarctic temperature they can live, possibly for many years.

The observations of Professor David and Mr. Priestley have thrown some new light on the geology and glaciology of Antarctica. Their chief conclusions may be summarized as follows:

1. The majority of the tabular bergs of Antarctica are largely, in some cases wholly, snowbergs. True icebergs are also found. The glaciers push out in some cases thirty miles from the coast, and must be afloat for the greater part of this length. Throughout Victoria Land, there is evidence of a recent great diminution in the glaciation. McMurdo Sound was formerly filled by a branch of the Great Ice Barrier, whose surface rose fully 1,000 feet above sea level, and whose entire thickness was about 4,000 feet.

2. Ross Sea is probably a great subsidence area. The Beacon sandstone formation which extends for at least 1,100 miles along Victoria Land contains coniferous wood associated with coal seams and is probably of paleozoic age. Radiolaria, in a fair state of preservation, occur in black cherts among the erratics at Cape Royds, and obscure casts of radiolaria are found in limestones at 85° 15′ S. Lat. These radiolaria appear to be of older paleozoic age. Peat deposits, formed of fungus, are now forming on the bottoms of some of the lakes in 77° and 78° S. Lat. Raised beaches of recent origin extend at Ross Island to a height of at least 160 feet above sea level.

The Great Ice Barrier remains the greatest mystery of the Antarctic, as well as the most interesting problem in the whole field of glaciology. It may be a bay surrounded by mountains, or it may be a strait extending from Ross Sea to Weddell Sea, or from Ross Sea to between Alexander Land and King Edward Land. Some increase of knowledge as to its formation has, at least, been gained. It moves at the rate of about 500 yards annually towards Ross Sea; it calves away in places, as is proved by the disappearance of Scott's Balloon Bight; and these large masses which break off form great tabular bergs. It is fed to some extent from the great glaciers which pour down into it from the mountains, but it seems mainly formed from the accumulation of the snowfall. Messrs. David and Priestley think it consists of true glacier ice at its sides and inland extremity, but that the center and seaward portion is formed, in its

upper part, chiefly of snow. They agree with Captain Scott's conclusions that, except at its edges and perhaps some distance inland, it must be afloat.

Another most interesting Antarctic problem still remaining unsolved is that of the continuation of the mountain range of West Antarctica. This extends from the Shetlands to Alexander Land and is certainly a continuation of the Andes. It may be that this West Antarctica range runs to King Edward Land, or it may be that it runs to Victoria Land. At any rate, the furthest southern mountain ranges seen by Shackleton point in the direction of Alexander Land. The observations of Messrs. David and Priestley led them to think that the coast line of Victoria Land is of an Atlantic rather than of a Pacific type and they conclude "Possibly as Wilckens has suggested, west of Alexander I. Land, the cordillera is submerged through faulting." Dr. Charcot is at present engaged in trying to get further south than Alexander Land, so let us hope he may bring back some further data about this noteworthy problem in physical geography.

A third most important geographical problem in the Antarctic is the coast line of Antarctica. While Shackleton made no special effort to explore any of this, still he accomplished a good deal. He sighted about 45 miles of new coast line, running first a little south, then due west, of Cape North. As this coast has not received a name, I suggest it be christened "Shackleton Land." While Shackleton's southern journey in no wise solves any coastal problem, nevertheless it enlarges so much the known size of the ice-capped plateau of East Antarctica that it much increases the certainty that this plateau must extend, not only to Wilkes Land, but probably also towards Enderby Land and Coats Land, both of which may turn out to be part of the edge of the great ice plateau of East Antarctica.

Shackleton's expedition is certainly one of the most memorable on record. To all intents and purposes, he has solved the problem of the South Pole itself. The next expedition to Ross Sea may get there, but by so doing, will probably add little to knowledge. The greater problems before such an expedition will be to trace the continuation of the Victoria Land mountains and the southern boundaries of the Great Ice Barrier. It will, however, be no small task for anyone to surpass the efforts of Sir Ernest Shackleton, who is evidently not only a great explorer, but a born leader of men.

TRADE ROUTES IN THE ECONOMIC GEOGRAPHY OF BOLIVIA

BY

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The economic condition of Bolivia has been so profoundly affected by two railway lines from the seacoast to the principal plateau towns, La Paz and Oruro, and the country is being so rapidly developed by other railway lines now building, that the Bolivia of but twenty years ago is almost completely transformed (Fig. 1). In this respect it

FIG. 1.

compares with Mexico, whose industrial birth likewise dates from the completion of its first railway line to the United States, the line to the American frontier completed in 1884. In both countries the only general means of transportation until a comparatively recent

date were native carrier, pack train, and mule cart. In both cases a lofty tableland is the home of the white population and must be twice overcome in a single communication with the coast. Probably less than 7 per cent. of Mexico's population live on the lowlands of that country today.* In Bolivia less than 12 per cent. dwell upon the eastern tropical and sub-tropical plains.† These figures can only be compared by first noting that more than two-thirds of Mexico is upland while nearly two-thirds of Bolivia is plain (Fig. 2). This

FIG. 2.
From *Bull.* Geog. Soc. of Phil., Vol. 7, No. 2, 1909.

reverses the density ratios and gives Bolivia a much thinner plains population than Mexico. Both countries were long obliged to develop their chief resource, their minerals, under the most stupendous disadvantages that the modern industrial world exhibits.

If Mexico's former difficulties are appreciated, by virtue of our better acquaintance with a nearer neighbor, Bolivia's former difficulties may be best understood by noting that the tableland of Bolivia

* Costa Rica. G. E. Church. *Geog. Journ.*, Vol. 10, 1897, p. 76.

† Approximation, based on data from Geografia de la República de Bolivia, tables in handbooks of S. A., and other sources.

is from one and a half to two and a half times farther from the coast than is the tableland of Mexico and half again as high; and whereas the railway from Vera Cruz to Mexico City climbs to 7,200 feet, in crossing the edge of the tableland, the two lines from Mollendo and Antofagasta ascend to 14,666 feet and 13,700 feet, respectively, in order to reach Bolivia. Furthermore, once the coast of Mexico is gained, a comparatively short ocean voyage at cheap rates places her products in the markets of the largest industrial centers of the world; on the other hand the distance from Bolivia's western outlet ports on the Pacific to New York, by way of the Straits of Magellan, is several thousand miles farther than the direct distance from those ports to the North Pole.

What the isolation and loftiness of the Bolivian situation formerly meant may be illustrated by a few specific examples which will at the same time prepare the way for a discussion of existing transportation conditions and methods in those parts of the country that are not served by railways. In 1884, for instance, all the ores and metals of the Serrania de Guadalupe district in southern Bolivia were transported by mules and donkeys through Argentina to the port of Rosario,* approximately 1375 miles. One mine had been abandoned after the investment of £30,000. Pasley asserts† that he saw the bills of lading at the establishment, from which it appeared that £7,000 had been spent on freight alone from the port of Rosario. Nearly up to the time of the completion of the railway to Oruro from Antofagasta in 1892 the silver and tin of Potosi were transported to the Pacific seaboard, 500-575 miles away, by pack-train and mule cart at incredible cost, the returning caravans bringing back merchandise over the same steep and difficult way. In 1882, Minchin wrote‡ that the rate from Oruro to Tacna, the interior terminus of the railroad from the port of Arica (250 miles) was £15 per ton. Yet at that time the silver output of the country, in spite of these enormous disadvantages, was $8,000,000 to $10,000,000 annually. Ores containing 1 to 1½ per cent. of silver were more advantageously exported to Europe, in spite of high freight rates to the coast, for the value of the accessory minerals, copper, tin, etc., was often in itself sufficient to cover the total cost of transportation. There are more than 10,000 abandoned silver "mines" in Bolivia today.§ They were for the most part abandoned because of lack of capital or labor,

* Descriptive Notes on the Southern Plateau of Bolivia and the Sources of River Pelaya. C. M. S. Pasley. *Geog. Journ.*, Vol. 3, 1894, pp. 105–115.

† *Ibid*, p. 109.

‡ The Tableland of Bolivia. *Proc.* of the Royal Geog. Soc., London, Vol. 4, 1883, pp. 671–676.

§ *Bull.* Int. Bureau of Am. Repub., July, 1908, p. 72.

or both, or on account of ruinous transportation rates, or the flooding of the mines by water on account of the primitive mining methods employed. Among these factors, lack of good transportation facilities stands preëminent. The tax is not only upon the hauling of the mine products to the railway but also upon the enormous cost of machinery and materials of all sorts, especially fuel.

Mining development has often meant an increase in the cost of merchandise imported for general use. In 1861 the freight rates from Cobija, in what is now northern Chile (then Bolivia), to Calama in the Loa valley, 120 miles toward the northeast, were $8 per carga of 300 lbs. When the mines at Caracoles, 90 miles east of Cobija, were opened, they competed so successfully with the merchants for carts and mules for ore transportation that the cost per carga of 300 lbs. rose at once to $15. In 1871 the freight rates from Potosi to Calama (450 miles) were $30 per mule load of 300 lbs. The cost was due partly to the direct labor of transport and partly to the exceptional lack of pasturage and water, forage being a considerable part of the original cargo. The cost of moving a piano (400 lbs.) from Cobija to Potosi (575 miles) was then $320 to $350. To Sucre the price was $60 to $80 more. The freight on a single mule load of bottled beer was $36 to $42 from either Tacna or Cobija to Potosi. The price of goods conveyed by caravan was often increased 100 per cent. in the transit across Atacama and the western Andes to the central plateau. In other words, the average cost of taking a ton of goods from Europe to the central cities of Bolivia by these transportation methods was equivalent to the transportation of the same ton a distance of 20,000 miles by railway at average rates or six times the circumference of the earth by steamship.* These examples will serve to explain why nearly every student of Bolivia's transportation methods finds conditions there today and in the recent past so interestingly similar to that period in our own industrial development west of the Mississippi, in the '50's and later, when bullock cart and prairie schooner were being replaced by railroads.

The early cart roads and mule paths to the coast are of added interest because they are the routes of the railways either now completed or building. The number of these routes to the frontier and the coast was and is very definite, for there are few natural ways out of the country and these have all been used for centuries past. They will be taken up in turn for detailed discussion. The routes are briefly named and characterized as follows (Fig. 3):

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* The Route to Bolivia *via* the River Amazon, pp. 143, 148, 149, *et al.* G. E. Church, London, 1877.

FIG. 3.

Mollendo-La Paz. From La Paz, capital and largest city of Bolivia, over 500 miles west, to and across Lake Titicaca, and over a high tableland, lofty mountains, and the coast desert, to the port of Mollendo in southern Peru.

Arica-La Paz. From La Paz, through similar country, to Arica in Chile. This route would eliminate the double handling now necessary in crossing Lake Titicaca. Furthermore, the distance is shorter and the grades far more favorable. The port of Arica far surpasses Mollendo, both in size and security. It would bring La Paz within twelve hours of the coast.

Iquique-Oruro. From Oruro, on the alto planicie (high plateau) of Bolivia, 150 miles south of La Paz, west to Iquique on the Chilean littoral. Reasonable grades but an unproductive country. Route could not compete with Arica or Antofagasta.

Antofagasta-Oruro. Oruro is now connected with Antofagasta by a meter gauge railway completed in 1892. It has been the sole railway outlet for southern Bolivia, as the La Paz-Mollendo line has been for northern Bolivia, until the recent opening of the line from

La Paz to Oruro. This short connecting link now allows a choice of routes for plateau commodities.

Argentina-Bolivia. The road from Tupiza to Uyuni is now being completed. It follows stream valleys from the northern pampas in Argentina to Jujuy and through the southern border of the tableland of Bolivia to Tupiza and thence to Uyuni on the Antofagasta-Oruro line with which it will connect for northern Bolivia.

Plateau-Plains. Three related projects eastward from La Paz, Cochazamba and Sorata, have as their common object the opening of the eastern tropical plains of Bolivia to the plateau and the better connection of both plateau and plains with the Amazon and the Atlantic. The conquest of the eastern Andes and of the falls of the Madeira are important parts of this comprehensive scheme. It is unlikely that more than one line will ever be constructed.*

Paraguay-Santa Cruz. Surveys are now being prosecuted west of Corumbá on the Paraguay for a railway that shall connect Santa Cruz de la Sierra with the Paraguay. It is within the scope of Bolivia's present railway scheme to extend the plateau lines eastward to Santa Cruz which, if accomplished, would give Bolivia uninterrupted passage from the Pacific to the Atlantic.

Mollendo-La Paz.

The well-known Mollendo-La Paz line may be described briefly. It was begun in 1870 and completed to Lake Titicaca in 1874 and later to La Paz the capital. Formerly this was one of the caravan routes to northern Bolivia, and competed for supremacy with the route from Arica. The latter way, being shorter, was the more important, however, until the completion of the railway line, when it immediately dropped to small importance except as a mail route to Tacna and Arica. The La Paz mails are delivered to Tacna by swift coaches in five days and as even the railway journey from La Paz to Mollendo requires three days and European steamers are often as much as a week apart on the west coast it can readily be seen why this route frequently means an earlier mail to Europe than that to Mollendo and is therefore maintained.

It was an early aspiration of the best Peruvian statesmen to see

* The location of the principal custom houses of Bolivia will indicate the principal routes and the relation of the railways to the main lines of trade. They are as follows: Guaqui (Lake Titacaca), Oruro (the only large plateau city on the Antafagasta-Oruro line), Uyuni (at the point where the caravan trail from Argentina strikes the railway), Tupiza and Tarija (on the way from Argentina to Southern Bolivia), Puerto Suarez, Villa Bella, Abuna, Madre de Dios, and Bahia, on the eastern rivers of Bolivia for the collection of heavy export duties on rubber, chocolate, etc., and the lighter import duties on merchandise.

all the wealth which was originally carried by llamas and donkeys to the coast from Bolivia borne across Lake Titicaca by steamers and across the cold Maritime Cordillera by railroads. The interesting features of the early attempts in this direction were noted by Markham in 1874.* In the '40's an attempt was made by Costas to place a small steamer on the lake. He foresaw the important trade this would both create and serve. The products of the Peruvian and Bolivian forests and eastern valleys—timber, cinchona bark, chocolate,

FIG. 4.
From *Bull.* Geog. Soc. of Phil., Vol. 7, No. 2, 1909.

coffee, coca, fruit, rubber, etc.,—would be conveyed to the coast; the European manufactured goods and the sugar of the Peruvian coast valleys would be imported into Bolivia; a brisk trade in wool, silver, copper, and tin, would follow, and a local traffic in provisions. In 1861 the Peruvian government ordered two screw steamers in London, called the "Yaravi" and "Yapura." They were 20 ton boats of 40 H. P. and were sent out in pieces to the port of Arica, thence to Tacna by rail and finally across the Andes on the backs of mules to Puno,

* Railways in Bolivia. *The Geog. Mag.*, Vol. 1, Apr., 1874, pp. 36–41.

the port at the western end of Lake Titicaca. Several pieces were lost and the project was in abeyance until 1868 when Captain Melgar of the Peruvian navy was appointed to complete the work. He brought up workmen and materials from the coast to the port of Puno and there, in the total absence of all local resources, built a factory and a mole and launched one steamer in June, 1871, the other in March, 1872.

The railroad from Arequipa to Lake Titicaca was constructed by the Napoleon of Peruvian railroad engineering, Colonel Meiggs. He contracted for the line at £6,400,000 or £29,500 per mile. The cost of transport, and of the labor, materials, and provisions was of course enormous. Embankments from 50 to 500 feet high are numerous. In one place there is an 84-foot cut on a hillside with the roadway 1,000 feet of almost perpendicular height above the valley. The distances to water are often long, and from Arequipa to the baths of Yura, seventeen miles, the water was conveyed by mule-back. At Caniaguas it was carried twenty-six miles. The cold of winter at high altitudes is intense. The work was begun in June, 1870; from 4,000 to 5,000 laborers, mostly Chilians and Bolivians, were constantly employed for 3½ years; and on Jan. 1, 1874, the first locomotive reached the shores of Lake Titicaca, 12,500 feet above the sea. The highest point on the old road from Arequipa to Puno is 15,590 fect, that of the present railroad 14,666 feet (Crucero alto).

The building of the northern railway line meant the commercial rehabilitation of the entire region. For not only did it become possible to develop enterprises on the immediate line of the railway but many rich mining claims some distance from the railway, formerly impossible of development because of high freight rates, were found to be commercial possibilities even with mule transportation to the railroad. This principle of dependence of industrial enterprises upon proper means of transportation is abundantly illustrated by every railroad venture in the Republic. Even today there is vast mining development in the country away from the railways, which is possible because of the saving in long hauls to the coast that the part-rail shipments effect. Thus the rich tin mines at Huynuni, 30 miles from the railroad at Machacamarca, ship their concentrates by mule cart down the Huynuni valley and haul in their machinery, much of it extremely heavy, by the same route. Similar illustrations are abundant. Such mining development should not however be thought ideal. The expenses for the additional men, animals, and forage; the breakdowns, the limitations set upon the size and weight of machinery, the delays from swollen streams, and the trans-shipments,

these are but a few of the difficulties which the practical engineer of the region must meet.

One of the best illustrations of the expense incident in some localities on transshipment alone, are the copper mines at Coro-Coro. The partially treated ore from these properties is hauled in mule carts about 20 miles to the Desaguadero River where it is shipped in barges to Guaqui, the port at the eastern end of Lake Titicaca. It is then taken by lake steamers 140 miles to Puno; by freight train to Mollendo, the Pacific port; by barge from the wharf to the steamer

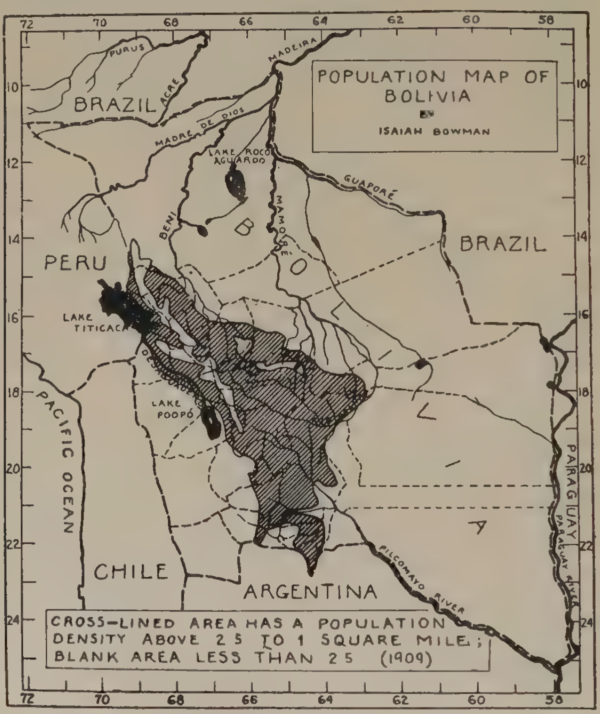

FIG. 5.
From *Bull.* Geog. Soc. of Phil., Vol. 7, No. 2, 1909.

conveying it to its final destination in southern Chile or Europe or the United States: counting the mining operation, the ore is handled *eight* times before delivery to the smelter. The locomotives, steel rails, ties, in fact all the material for the railroads now building in Bolivia must be unloaded into barges from the ocean steamers, after the voyage from the United States, then to the freight trains on the wharf, by rail to Puno, by steamer to Guaqui, and again by rail to the construction camps at the end of the line. What this means in

the case of heavy machinery and steel rails so awkward to handle can better be imagined than described. Every pound of coal must come by the same route at similar expense. Every tie (from Oregon and California) in the Viachi*—Oruro line costs $2 gold.

The Mollendo-La Paz line is of additional service because it made possible the branch to Oruro which is now completed and connects the two largest cities of Bolivia. Construction work has also been carried some distance toward Cochabamba and Potosi. The junction of the capital with Oruro brings about a political solidarity, itself as important for Bolivia's economic development as the railroads are important in their industrial effects. Four large cities, centers of as many great population groups, have developed in distinctly separate parts of Bolivia *viz.,* La Paz, Oruro, Cochabamba, and Sucre (Figs. 4 and 5). Revolutions have in the past gained dangerous headway in consequence and have been difficult to stamp out because of the distances to be overcome through the barren tracts that separate the various population groups. Quick transportation between Oruro and La Paz now gives these cities and the high plateau groups of people a balance of power over Sucre or Cochabamba acting individually. The extension of the railway to Cochabamba would effect still further consolidation politically; and, by offering cheaper communication, would lead to better acquaintance and greater friendliness than has heretofore been possible (Figs. 6 and 7).

Arica-La Paz.

Few railway projects in South America have been considered more frequently and seriously than that from Arica to La Paz, and none seems to be subject to more discouragements. The surveys from Tacna, the present interior terminus of the railway, have been made and actual construction has been begun repeatedly only to be delayed by the financial difficulties of the several companies. The latest contract has been awarded by the Chilean government to a German bank for £3,000,000.† The bank's interest in the matter ceases with the taking of the Government 5 per cent. bonds that are to be issued for the construction of the road. The line will be about 335 miles long and will be completed in four years according to the terms of the contract. The work is to be done in five sections. The government is to provide the right of way and,

* The station on the Molendo-La Paz line, 40 miles east of Guaqui, on Lake Titicaca, from which the Bolivia railway runs south to Cruro.

† Daily Consular and Trade *Report*, Jan. 30, 1908, No. 3087.

as is customary in railway construction in this section of South America, is to admit duty free all material and machinery used in the construction of the road. It is built in accordance with the terms of a treaty made between Chile and Bolivia, March 21, 1905, whereby Chile finally took over that portion of Bolivia which formerly bordered the Pacific.* The rich mineral resources of the section which

FIG. 6. THE PORT OF PUNO.

At the western end of Lake Titicaca. It is the eastern terminus of the railway from the coast at Mollendo, Peru. Steamers connect Puno with the port of Guaqui at the east end of the lake, where there is direct rail communication with La Paz.

the line will serve will mean much for both Chile and Bolivia and besides this there will be introduced a competitor to the Southern Railway of Peru now enjoying a monopoly of the trade of northern Bolivia.

IQUIQUE-ORURO.

The third route is one which has never been seriously considered as an actual rail route by the railway promotors of South America. The suggestion of the route is owing to Minchin† who called attention to the easy and regular grade of the western slope of the

* See any map of Bolivia prior to the war of 1880, or the treaty of 1883.

† The Tableland of Bolivia. *Proc.* of the Royal Geog. Soc., London, Vol. 4, 1882, pp. 671–676.

Andes east of Pica, an oasis 14 miles from the nitrate railway to Central Lagunas, in the province of Tarapacá, northern Chile. Our own observations show that the direct grades are here from 3° to 7° to an altitude of 14,500 feet and the topography and drainage along the route are favorable for the easy construction, by moderate curves, of grades below the lesser value. This railway would have to reach an altitude of nearly 16,000 feet if it crossed the Sillilica range and entered Bolivia via Cueva Negra and Cancosa, but only 14,000 feet if it entered the interior basin south of the volcano Sacaya by way of the borax lake, La Queca, and the town of

FIG. 7. THE PORT OF GUAQUI, LAKE TITICACA.

A dredged channel is maintained between the docks and the open lake, for the lake border is here fringed with extensive marshes.

Canquilla. The road could be constructed for much less than it cost to build either the Antofagasta or the Mollendo line. There are no towns of consequence along the route, merely isolated mountain villages of shepherds who supplement the resources of their flocks by cultivating such alluvial fans as can be irrigated. The chief advantage of such a line would lie in the development of the rich mineral deposits known to occur throughout much of this section of the Maritime Andes, a development that waits absolutely upon the cheap transportation which only the railroad can bring. The existing

trade over this route is in millet, firewood, wool, and skins brought down by the mountain Indians in llama caravans to the oases on the eastern edge of the desert of Tarapacá-Pica, Matilla, Macaya, etc., and there exchanged for cloth, alcohol, fruits, candles, and a host of lesser articles. The trade, while regular, is not considered important enough to warrant the maintenance of a custom house, and smuggling is not only the rule but is winked at by both Chile and Bolivia.

Antofagasta-Oruro.

Before the construction of the railway (completed to Oruro in 1892), over this ancient route, caravans from all that part of the altiplano,* of Bolivia between Potosi and Tupiza converged at Calama, a well-watered oasis in the Loa valley and now a station on the railway a day out of Antofagasta. From Calama two routes led out to the coast, one toward Tocopilla, now an active nitrate port, the other toward Antofagasta and Mexillones. The railway has taken advantage of the same depression in this part of the Andes that guided the routes of the earliest caravans to Calama, a town of several thousand inhabitants. Thence it ascends to a 13,700 ft. pass north of the twin peaks, San Pedro and San Pablo, to enter the great central basin *via* the borax lake, Ascotan. The Lake has an area of 60 or 70 square miles and lies between the volcanic peak of Ascotan and Ollague. The "lake" is really a bed of borate of soda with numerous scattered pools of salt water. The salt crust is from 2 to 7 feet thick and so firm that the old cart road to the coast passes over it. A borax establishment has been manufacturing the deposit on a large scale since the introduction of the railway.

Among the industrial readjustments which the railroad has effected none is more interesting than the retrogressive effect which for a short time the railroad had upon the oasis of Calama (Fig. 8). When it lay on the route of the caravans between seacoast and interior its fertile fields and luxuriant pastures were a source of great wealth to those owners who supplied forage to the pack mules. As soon as this caravan trade was largely supplanted by the more efficient railway service, Calama became only a way station on the railway and was obliged to become self-dependent. While, by virtue of its position, it still attracts the caravan trade of a small district toward the southeast, it is to a much larger extent deprived of the advantages of its former trade relations. For a short time this loss of strategic position was keenly felt, but the recent rapid development of the

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* The name given to the high plateau of Bolivia. Often called altiplanicie, central basin, central plateau, etc.

nitrate establishments on the nitrate pampa of Antofagasta has once more stimulated the production of forage for the thousands of mules employed on the caliche carts of the nitrate works, and Calama is now without exception the chief hay producing centre in the whole northern half of Chile. It is correspondingly prosperous, as may be

FIG. 8. SAIL CAR.

On the Antofagasta-Bolivia railway near Calama, Chile. The workmen take advantage of the almost constant winds to run into port at nightfall, literally "blowing into town."

appreciated when one considers the utter barrenness of the nitrate region of Antofagasta and the necessity of importing from southern Chile and Calama the entire forage.

Until the completion of the line between Oruro and La Paz (1908-1909), trains ran daily as far as Calama, but only three times a week from there to Oruro. The gauge is but one meter and the rolling stock of rather a primitive sort, though Pullmans have lately been introduced and the time between Oruro and the coast shortened. The port of Antofagasta is habitually congested and the mine owners of the interior complain constantly of the lack of ore cars for coastal shipments (Fig. 9). This deficiency, whether due to the defective administration of the road or to the actually great amount of traffic,

would be remedied by the competition which the Uyuni-Tupiza line, when completed, would afford. The present condition of the traffic may be judged from the fact that a copper smelter at Calama is able to supply itself with machinery only after the lapse of at least a year. Six months have to be allowed for the delivery at Antofagasta of consignments of machinery from Liverpool and six months for the day's journey to Calama. It may confidently be stated that, unless the gauge is widened and the rolling stock and service improved, the mining development of the region served by the line will soon be unable to increase, notwithstanding the invaluable service which the railway has in the past rendered both the nitrate industry

FIG. 9. THE PORT WORKS AT ANTOFAGASTA.
Steamers anchor off-shore (right background) and the cargo is discharged by means of lighters shown tied to the docks. The sacks on the wharf are filled with nitrate.

of the coast and the mines of the interior. The alternative would be the completion of rival railways on the plateau. But such competition can no longer be expected, as certainly was expected when the Bolivia Railway Co. was first organized.

The original plan of operation of the Bolivia Railway Co. frankly included competition with the Antofagasta and Bolivia Railway Co. (Limited). To the north it would connect (at Viachi) with the Mollendo-La Paz line and, to the south, via Potosi and Tupiza, with the Argentine system at La Quiaca. This whole arrangement has, however, been upset by the fact that on Dec. 1, 1908, President Montes of Bolivia signed a bill, recently passed by the Bolivian

Congress, embodying changes in the original concession of the Bolivia Railway Co. The changes were made at the request of the American syndicate building the road. It is a step toward the consolidation of the interests of these two roads and will undoubtedly result in the unification of the railway systems of Bolivia. By the terms of the agreement now embodied in the law, the British company (The Antofagasta and Bolivia Railway Co.) guarantees the interest on the new line of the American company (The Bolivia Railway Co.) just completed between Viachi and Oruro, and makes a payment to the American syndicate for a majority of the new line's stock. The original terms of the American syndicate's concession were still further modified with reference to the remaining lines now projected or actually under construction. It is the general purpose of these changes to make the new lines serve as feeders instead of competing lines to the Antofagasta Railway.*

* *Bull.* of the Intern. Bureau of Am. Republics. Jan., 1909, p. 111 *et seq.*

(*To be continued.*)

THE EXPLORATION OF THE UPPER AIR*

BY

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Much light has been thrown upon the movements and conditions of the higher atmosphere by observations made upon mountain summits, such as Ben Nevis, and we hope that some day there will be again a high-level station somewhere in the British Isles—supported by Government. It is indeed true that observations made upon mountain peaks and those obtained from some point in the free atmosphere represent different sets of conditions, and that the presence of the mountain itself affects the records. For example, it is probably true, as a rule, that the air on a mountain summit is

* This excellent summary of the nature and results of researches in the free atmosphere, made during the past few years, is reprinted from the annual *Journal* of the Scottish Meteorological Society, Edinburgh, Vol. 15, 3d Series, No. 26. The footnotes give references to publications in which may be found the original accounts of these researches. The *Bulletin* is indebted to Mr. Watt and the Scottish Meteorological Society for the opportunity to reprint this paper dealing with, perhaps, the most brilliant chapter in the history of meteorology.

distinctly colder than that at a point at an equal height in the free air close by. But we are not aware that any advocate of high-level stations has claimed that mountain observations should be regarded as identical with those made in the free atmosphere; and the fact remains that, as a rule, of all observations made at a considerable height, only those obtained from some point on the earth's surface could be reported to a central office in time to be charted on the current Daily Weather Map, and examined in connection with simultaneous low-level readings within an hour or two of the time of observation. On the other hand upward soundings in the free atmosphere are restricted neither by latitude nor by longitude, and many observations have been obtained from points at more than twice the height of Everest above the level of the sea. Modern meteorology has become a science dealing with space of three dimensions.

The exploration of the free atmosphere has been conducted by means of—(1) kites; (2) manned balloons; (3) "ballons sondes," or balloons carrying self-registering instruments only. Pilot-balloons carrying no instruments, and liberated merely to show the drift of the upper-air currets, are also used. It will be convenient if we give brief historical notes on the development of these various agencies.*

First of all, as regards kites. It is commonly supposed that Benjamin Franklin, in his famous experiments for collecting atmospheric electricity, made at Philadelphia in 1752, was the first to use the kite for scientific purposes. But that is not the case, for, three years earlier, Dr. Alexander Wilson, Professor of Practical Astronomy in the University of Glasgow, had used kites to raise thermometers in the air in an attempt to investigate the temperature at different heights.† Apparently nothing further was done until towards the middle of the nineteenth century, when Espy, in America, did some useful work. Later, in the eighties, Archibald, in England, experimented extensively on the best form of kite, and was the first to use pianoforte steel wire, which was at once stronger, smaller, lighter, and cheaper than that of copper and iron, formerly used. But it was not until Mr. A. L. Rotch took up the matter at his private observatory on Blue Hill, near Boston, in Massachusetts, that a systematic investigation of the upper air by means of kites was anywhere attempted. That now famous observatory was

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* Anyone dealing with the history of the subject must be greatly indebted to A. L. Rotch's "Sounding the Ocean of Air." (London: Society for promoting Christian Knowledge.)

† *Trans.* Roy. Soc. Edin., vol. x. part ii. pp. 284–286.

founded by Mr. Rotch in 1885 on ground purchased by him, and for more than twenty years reports of the various investigations have been published by Harvard University. Kites were first employed in 1894, and since that time a continuous survey of the atmosphere up to a height of about two miles has been conducted, yielding results of the greatest value. The kites employed at Blue Hill are of a modified Hargrave or box pattern, and the Blue Hill type has been very generally adopted elsewhere.* As a rule, two or more kites linked together are used, and, as far as we are aware, the highest observations ever secured by means of kites were made by a team of six from Lindenberg, near Berlin, in November, 1905, when an elevation of about 21,000 feet was reached.†

In 1901 the exploration of the atmosphere by means of kites received a great impetus. The method had obviously its limitations; there might be too much wind or too little, and an extensive kite campaign organized by the Weather Bureau of the United States of America was not a complete success owing to the lightness of the winds experienced.‡ It was found that at a land station kites could be raised only in a wind of twelve miles per hour, and that in calm anti-cyclonic weather they were of but little use. Mr. Rotch now suggested that from a steamer, where even in calm weather there was always an artificial wind equal to at least the speed of the steamer, kites could be flown in all weathers, since the lifting powers of strong winds could be modified by steaming against or at an angle to them; and Mr. Rotch, after some preliminary experiments, himself demonstrated the value of his suggestion by making some very successful kite flights in crossing the Atlantic in the steamship *Commonwealth* at the end of August, 1901.§

This enterprise may be said to have been the inspiration of the recent energetic work in England in upper-air meteorology, for Mr. Rotch's account of his experiments to the British Association at Glasgow (September, 1901) made such a deep impression that a grant was voted to initiate experiments by means of kites, and a joint committee of the Association and of the Royal Meteorological Society was appointed to administer the grant.‖ This committee, with Dr. Shaw as chairman, and Mr. W. H. Dines as secretary, has

* For accounts of founding of Blue Hill Observatory, introduction of kites, description of apparatus and methods, and results, see *Annals* of the Astronomical Observatory of Harvard College, especially vols. xx. part i., xlii. part i., and xlviii. part i.

† *Ergebnisse der Arbeiten des Königlich Preussischen Aeronautischen Observatoriums* (1905), Band i. p. 63, Berlin, 1906.

‡ U.S.A. Weather Bureau, Bulletin F.

§ *Nature*, vol. lxv. pp. 4, 545.

‖ *British Association Reports*, 1901–1908,

been reappointed from year to year, though latterly without a grant. Aerial research in the British Isles is greatly indebted to the vigorous work of the Royal Meteorological Society, whilst during the last four years the Meteorological Committee have assigned a considerable sum for the work, with Mr. Dines as their official investigator. The first soundings of the free upper air in this country were made by Mr. Dines from a small steamboat at Crinan in the summer of 1902; that place recommending itself by its comparative seclusion and its proximity to the Atlantic and to Ben Nevis, and the Crinan ascents have been continued in succeeding summers. It is probably a sign of the times that one of the younger universities has been the first to associate itself with meteorological research in England, for the Physical Laboratory of the University of Manchester has established at the Howard Estate, on Glossop Moor, a well-equipped station for the investigation of the upper air. Since the Meteorological Office has associated itself with the work, results of ascents from various stations are published with remarkable promptness in the *Weekly Weather Report,* so that within a few days of the close of each week there is available a very full account of the low-level meteorological conditions of the week, and also a considerable amount of information as to the conditions at higher levels. At present there are, as a rule, reports from the Glossop Moor station; from Mr. Dines at Pyrton Hill, in Oxfordshire; and from two enthusiastic private observers—Mr. C. J. P. Cave, of Ditcham Park, and Mr. S. H. R. Salmon, of Brighton.*

We pass now to the use of balloons in aerial meteorology. The effective history of ballooning begins with the work of the Montgolfier brothers in France towards the end of the eighteenth century. In 1783, an ascent was made in a "Montgolfière," or heated-air balloon; in the same year the physicist Charles reached an elevation of 9,000 feet above Paris by means of a balloon filled with hydrogen gas; and two years later the Channel was crossed from the English side by a Frenchman and an Englishman in company. Very early the balloon was recognized as of great value for scientific research, and in the early years of last century some well-known names in French science were associated with scientific ballooning. Thus, in 1804, Gay-Lussac reached a height of 23,000 feet, making magnetic and temperature observations. In England, in the fifties, John

* For accounts by Mr. Dines of his methods and instruments, see the *Quarterly Journal* of the Royal Meteorological Society, vol. xxix. (1903) p. 65, and vol. xxxi. p. 217; and for various reports on upper-air work, that *Journal*, vols. xxviii. 1, xxx. 155, xxxii. 15 and 29, xxxiv. 15, xxxv. 15 and 37. See also the *Reports of the British Association*, 1902 *et seq.*, and the *Annual Reports of the Meteorological Committee*, especially the Third Report (1908), pp. 43–49.

Welsh, of Kew Observatory, made some important ascents; and then we come to the splendid work of James Glaisher, who, along with Coxwell, the aeronaut, made about thirty ascents between 1862 and 1866, which are described in great detail in the Reports of the British Association. A height of 23,000 feet was thrice exceeded, and on one memorable occasion, from Wolverhampton, on 5th September, 1862, a height of more than 29,000 feet was reached, both Glaisher and Coxwell losing consciousness at that great elevation. Various considerations, such as a comparison of the rate of ascent when he lost consciousness, and the rate of descent when he recovered consciousness, thirteen minutes later, and the fact that "a very delicate minimum thermometer read minus 11°.9 (F.), led Glaisher to the conclusion that a height of 36,000 or 37,000 feet, or fully seven miles, had been reached. This, however, seems doubtful; but, in any case, Glaisher's great feat has been equalled or excelled only in Germany.*

It may be said that aerial research by means of manned balloons in England since Glaisher's ascents of more than forty years ago has been merely spasmodic, and, though other countries have had some small share in research by this means, in Germany alone has this method of work been vigorously pursued. The use of manned balloons obviously involves great expense, and Germany has now in the Imperial Aeronautical Observatory at Lindenberg, near Berlin, of which Dr. Assmann is the distinguished director, by far the most elaborate place of the kind in the world. The German School of Scientific Aeronautics has given great attention to the best exposure of instruments, and the "aspiration psychrometer" of Dr. Assmann has solved a serious difficulty. Thus the temperature readings obtained at great heights by Glaisher were higher than one would *à priori* have expected, and it is now recognized that his thermometers were probably not sufficiently protected from the direct rays of the sun, and that in any case the car of the balloon in which the instruments hung became in its rapid ascent practically a well of relatively warm air which had not time to acquire the true temperature of the various strata through which it passed. These difficulties are entirely overcome by using a properly exposed Assmann psychrometer, in which a fan driven by clockwork ensures a proper circulation of air round the bulbs of the thermometers.

Some great heights have been reached on the German balloon ascents, and that of 31st July, 1901, from Berlin, on which Süring and Berson reached a height of 10,800 metres, or about 6¾ miles,

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* *British Association Reports*, 1862–1866.

probably represents the extreme altitude attainable by human beings even with the help of artificial means of respiration. On this remarkable voyage the balloon was in the air for seven and a half hours, and came to earth nearly ninety miles from Berlin. Both observers fainted before the highest point was reached, which was determined from a barograph trace, and made their last temperature observation at a height of 10,225 metres, or about 33,500 feet, that is at a point more than 4,000 feet above that at which Glaisher and Coxwell lost consciousness. The temperature at this point was —39°·7 C. (—39°·5 F.), and already at a much lower level the aeronauts found it "empfindlich kalt."

The German upper-air work has been of the most thorough description and affords perhaps the only available material for a thorough study of day-to-day temperature changes in the free upper air.*

Whilst Germany may be said to have perfected the use of the manned balloon, and America, or perhaps rather an American, the use of the kite, to M. Teisserenc de Bort, of Trappes, near Paris, falls the credit of having perfected the use of the "ballon sonde," by which the free atmosphere has been explored to an amazing height. It is true that already, in 1892, MM. Hermite and Besançon had sent up to considerable heights balloons made of gold-beater's skin and carrying simple instruments,† but it remained for M. de Bort to fully develop this method, and in 1898 he made some important discoveries by means of large paper balloons covered by a net. Meanwhile Dr. Assmann in Berlin was experimenting with small rubber balloons such as are now universally employed. These are inflated with hydrogen gas only sufficiently to give them an initial upward velocity, and as pressure goes on diminishing with increase of height the gas expands till a point is reached when the balloon bursts, gradually falling to the ground under the protection of a parachute. Though these balloons often travel great distances, the instruments are recovered in a surprising number of cases, and some remarkable elevations have been reached, occasionally more than sixteen miles. M. de Bort's methods have been followed in many countries, and by means of "ballons sondes" the ocean of air has been sounded to

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* See "The temperature of the Air above Berlin from 1st October, 1902, until 31st December, 1903, as shown by the Daily Ascents executed by the Aeronautical Observatory of the Royal Meteorological Institute of Prussia." By Professor Dr. Richard Assmann (Berlin), 1904.

Ergebnisse der Arbeiten am Aeronautischen Observatorium. (4 vols. Berlin, 1902–1905).

Ergebnisse der Arbeiten des Königlich Preussischen Aeronautischen Observatoriums bei Lindenberg. (3 vols., Berlin, 1906–1908).

† *Comptes Rendus* Paris [C.R.], vol. cxv. p. 862.

great heights at many places from St. Petersburg in the east to St. Louis in the west, and from the Arctic Circle to the Equator.

It remains to add that observations of the direction of cirrus clouds have told us a great deal about the movements of the upper air at great heights, and that much useful work has been done by means of pilot balloons.

We have now indicated the various methods by which the exploration of the upper air has been carried on, and may now briefly describe some of the results, dealing chiefly (1) with researches made on the general circulation of the atmosphere, and (2) with investigations of the temperature conditions of the atmosphere at great heights.

When Rotch described to the British Association in 1901 his own successful experiments on the use of kites at sea, he suggested the trade-wind region of the North Atlantic as a promising field for research. You have there the more or less permanent North-East trade, flowing down to the thermal equator where there is a great uprush of heated air, and the problem offered is as to how exactly this air is transferred again to higher latitudes. However, before Rotch himself had an opportunity of exploring the region, Professor Hergesell of Strassburg had secured the co-operation of the Prince of Monaco, and in the summer of 1904 made a cruise of investigation in the *Princesse Alice*. The field covered was the part of the North Atlantic bounded by Spain, the Azores, and the Canaries, and much important information was obtained as to the variation of temperature and humidity with height, etc. One result, however, was of a most unexpected nature. It had long been held that above the North-East trades there flowed the "anti-trade," or return current, from the South-West; and the fact that the prevailing wind on the Peak of Teneriffe, some 12,000 feet high, was from that point confirmed this opinion. Hergesell, however, though his upward soundings on several occasions reached a greater height than 12,000 feet, found no indication of the upper "anti-trade," and concluded that the South-Westerly current observed on the Peak of Teneriffe was due to local influences.*

Hergesell's conclusion was so unexpected that it seemed to Rotch and De Bort an urgent matter that further investigations should be conducted, and, in the following summer (1905), they organized an expedition in the steam yacht *Otaria*,—Mr. Clayton of the Blue Hill Observatory and M. Maurice of Trappes acting as meteor-

* *C.R.*, cxl., 331.

ologists. A leisurely voyage was made from the Mediterranean by way of Madeira, the Canaries, and the Cape Verde Islands, as far as latitude 10° N., returning by way of the Azores. Many kite flights were made up to a height of more than a mile, and the wind direction at great heights was observed by means of pilot balloons whose trajectories could be followed up to a height of six or seven miles.† The general result of the expedition may be summed up as follows: The existence of the South-West anti-trade, which theory demanded and the winds on the Peak of Teneriffe indicated, was absolutely confirmed. It was found, however, that the variation of wind direction with height was not altogether simple, and that there was not an immediate transition from a North-Easterly to a South-Westerly direction. The North-East trade was found to be of varying thickness; above that was a layer of North-Westerly winds; and above that the return current up to a height of at least six or seven miles, with a direction varying from South-East to South-West. It was found that the velocity of the trades decreased rapidly with height. Further voyages were made by the *Otaria* in 1906 and 1907 into mid-Atlantic and as far South as Ascension.‡

We may here conveniently point out that earlier theories of the general circulation of the atmosphere, which conceived that part at least of the upper return current from equatorial regions extend to the pole, have been disproved by systematic observations of the direction of the high cirrus clouds in higher latitudes. For it has been shown that in the temperate zone in both hemispheres there is a general motion of the upper air from West to East; indeed, this drift towards the East has been found at least as far North as the Arctic Circle. And to the South of the Equator we have the South-Easterly trades underlying the North-Westerly anti-trades, as has been fully proved by observations of the direction of the upper clouds over Mauritius. Above the region of equatorial calms there flows a steady upper current from the East, as was demonstrated in the most striking manner after the eruption of Mount Krakatoa in August, 1883, for "the optical phenomena caused by the volcanic dust which was carried up into the uppermost layers of the atmosphere travelled round the world from East to West in about twelve or thirteen days, from which it follows that these uppermost currents are endowed with a velocity from the East of eighty-three miles per hour. This velocity is very nearly the same as the mean

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* *Nature*, vol. lxxii. 244, lxxiii. 54.

† *Nature*, vol. lxxx. 219.

velocity of the upper clouds at Washington, and is therefore not at all inconceivable."*

But we cannot leave this part of our subject without referring to an aerological expedition sent out to tropical East Africa in the summer of 1908 by the Royal Prussian Aeronautical Observatory at Lindenberg, though only a sketch of the work done is as yet available. The enterprise, official and private, that despatched such an expedition into the heart of a tropical continent must command the highest admiration. Professor Berson was the leader, and the greater part of the work was conducted from the shores and waters of Lake Victoria Nyanza. A full report of the various researches will be looked forward to with the greatest interest, and it is certainly a very surprising fact that whilst the regular Easterly upper current of the equatorial regions was found, there was on several occasions "an uppermost current of air flowing from due West."†

Passing now to the chief results of studies of temperature conditions in the free atmosphere, we may at once discuss the remarkable discovery by M. de Bort of the so-called "isothermal layer." It was known that temperature inversions occurred, in certain circumstances, on the surface of the earth. Especially is this the case during anti-cyclonic weather in winter, and as an extreme example we may instance a striking departure from the normal relationship between the summit and the base of Ben Nevis that occurred during the great frost of January and February, 1895. The average difference of temperature between Ben Nevis and Fort William ranged from 16°·8 F. in April to 14°·4 in December, the mean for the whole year being 15°·4, whilst at 9 A. M. on 19th February, 1895, the summit was no less than 17°·6 *warmer* than the base. (B.N.O., 33°·6, F. W. 16°·0.)‡

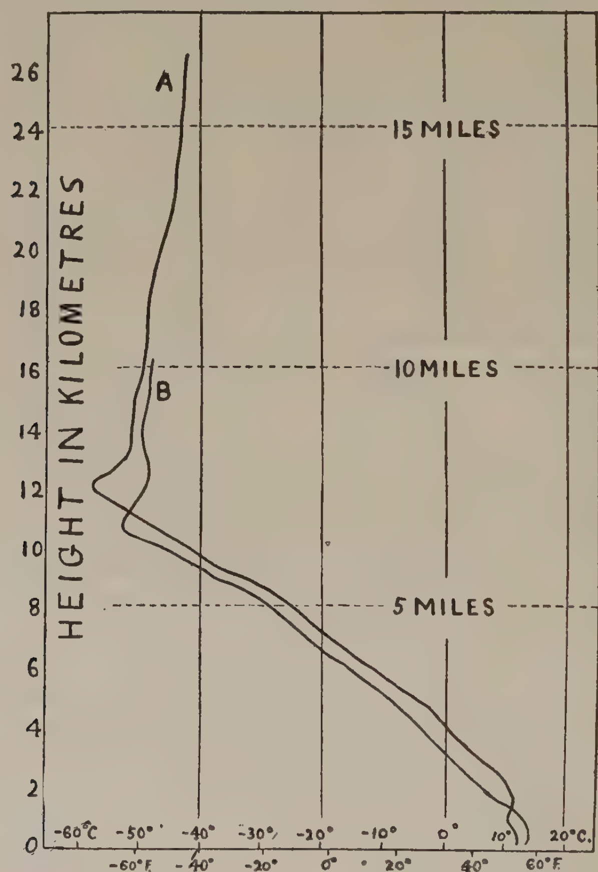
When we pass from the surface of the earth to the free atmosphere we find that there also inversions are met with at moderate and varying heights up to a level of some two miles or more, that is throughout the region in which nearly all clouds except the cirrus are formed. Above this comes a much thicker layer, in which temperature decreases with remarkable regularity, and the ascents of kites and manned balloons had given no indication that this decrease did not go on indefinitely. M. de Bort, however, had not been long at work at Trappes with his "ballons sondes" when he was

* See Dr. Hildebrandsson's Report to the Permanent International Meteorological Committee on "The International Observations of Clouds," translated in *Quarterly Journal*, Royal Met. Soc., vol. xxx, pp. 317–343.

† *Nature*, vol. lxxx. p. 171.

‡ See a communication by the writer in *Nature*, vol. lxxi. 583.

able to make the announcement that after a certain height, varying from five to nine miles, the fall of temperature ceases and is very often actually reversed. This uppermost region he proposed to call the "zone isotherme," and probably the title "isothermal layer" generally adopted in England has come to stay. It is not, however, altogether satisfactory, as the region indicated is seldom more than approximately isothermal. Moreover it is inappropriate to describe as a layer a region of which the uppermost limit has not yet been reached.*



TEMPERATURES OBTAINED ON "BALLONS SONDES" ASCENTS.

The phenomenon of the "isothermal layer" is well shown in the temperature records obtained on two characteristic "ballon sonde" ascents which are charted in the accompanying diagram. The

* *C.R.*, cxxxiv. 987, cxxxviii. 42, cxlv. 149.

Belgians have been very successful in reaching great elevations, and the curve marked A refers to an ascent made from Uccle, near Brussels, on 25th July, 1907, when a height of fully twenty-six kilometres, or more than sixteen miles, was attained. Curve B refers to an ascent made from Trappes two days earlier. It will be observed that in both cases an inversion of temperature occurred near the ground, followed by a long gradual decrease of temperature with a sudden change of gradient at a great height. In A the lowest temperature recorded occurred before the balloon had reached more than half its extreme elevation, and at a height of fifteen miles the temperature was as much as 14° C. (25° F.) higher than at seven and a half miles.

As a further illustration of the phenomenon of the "isothermal layer" we give below actual numerical results obtained on another high ascent from Uccle on 5th November, 1908.* Two rubber balloons in tandem were employed, as is very commonly done, and these remained in the air for nearly two hours, and were recovered at a place about fifty miles to the SSE. The greatest height reached was 29,040 metres, or about eighteen miles, and the lowest temperature, —67°·8 C. (—9°·0 F.), was experienced at 12,950 metres, or about eight miles, that is before the balloon had reached more than half its extreme elevation, as was also the case on the ascent referred to in curve A of our diagram.

Height.		Temperature.	
Metres.	Miles. (Approximately.)	C°.	F°.
100	....	4.4	39.9
500	....	3.9	39.0
1,000	....	1.7	35.1
1,500	....	—3.3	26.1
2,000	....	1.2	34.2
2,500	....	—0.2	31.6
3,000	....	—3.2	26.2
4,000	2.5	—8.7	16.3
5,000	....	—14.4	6.1
6,000	....	—21.4	—6.5
7,000	....	—28.3	—18.9
8,000	5.0	—36.2	—33.2
9,000	....	—44.3	—47.7
10,000	....	—52.0	—61.6
11,000	....	—58.4	—73.1
12,000	7.5	—64.3	—83.7
13,000	....	—67.6	—89.7
14,000	....	—65.0	—85.0
15,000	....	—64.8	—84.6
16,000	10.0	—64.1	—83.4
17,000	....	—63.6	—82.5
18,000	....	—62.9	—81.2
19,000	....	—62.6	—80.7
20,000	13.0	—62.6	—80.7
21,000	....	—62.3	—80.1
22,000	....	—62.1	—79.8
23,000	....	—61.8	—79.2
24,000	15.0	—62.3	—80.1
25,000	....	—62.5	—80.5
26,000	16.2	—62.7	—80.9

Thus a well-marked temperature inversion occurred at the height of 1,500 metres, and after a height of thirteen kilometres, or

* *Ciel et Terre*, 1st January, 1909.

about eight miles, there was a decided rise of temperature for a considerable distance. During the last five miles of the ascent variations were but slight.

It may be pointed out that De Bort's discovery of the isothermal region had, in a way, been anticipated by MM. Hermite and Besançon. They, however, could not believe in the actual existence of a region of relatively warm air at a great height, such as was apparently indicated by their instruments, and considered that their observations became unreliable in the rare upper air, owing to the effect of the intense solar radiation there experienced.* But M. de Bort submitted to the Academy of Sciences of Paris in 1902 an exhaustive account of his researches, and expressed the confident opinion that the unexpected results of temperature observations at great heights represented a physical fact. He had indeed been satisfied of this some years earlier, but had carefully improved his methods, in particular devising means of regulating the speed of ascent of the balloons, so that the instruments should have time to accommodate themselves to the varying temperature conditions of successive heights. Moreover, his ascents at Trappes had been made at night, so as to avoid the direct effect of solar radiation. Taken along with experimental work by Professor Assmann in Germany, M. de Bort's researches placed the reality of the isothermal layer beyond doubt. Quite recently the matter has been thoroughly discussed in an interesting correspondence in the columns of *Nature* (vols. lxxvii.-lxxx.).

M. de Bort's work has been followed up in many countries. He himself, in 1907, organized an expedition to Kiruna, in Lapland, just within the Arctic Circle, and there, too, the isothermal layer was found to exist.† It had been found, too, many times in England; in several countries of the continent of Europe; in America, from St. Louis, by Mr. Rotch; by Professor Hergesell and the Prince of Monaco, in the neighborhood of the Azores; and on the cruises of the *Otaria,* as far south as 25° N. It had, however, not been found to the south of that parallel, though aerial soundings over the equatorial Atlantic had several times exceeded 15 kilometres.‡ M. de Bort, therefore, regarded the phenomenon as universal, except as regards the tropics. Now, however, even that restriction may be removed, for on the German expedition of last year Professor Berson found the upper temperature inversion on several occasions at great heights over tropical East Africa.§

**C.R.*, cxvi. 766. †*C.R.*, vols. cxlv. 149. ‡*Nature*, vol. lxxx. 219. §*Nature*, vol. lxxx. 171.

In one of his earliest communications, M. de Bort had pointed out that the height of the isothermal layer varies with variations of the sea-level pressure distribution, lying nearer to the ground than its average height over a low-pressure area, and farther from the ground above high-pressure areas. And what is true as regards a particular point, is true on a larger scale, for there appears to be a gradual increase in the average height of the layer as we pass from the lower pressure of the polar regions into the heart of the Atlantic anti-cyclone. In America, Rotch's investigations from St. Louis, in Lat. 35° N., showed that there the warm stratum is "at a decidedly higher altitude than it is in Northern Europe."*

Another remarkable discovery in connection with the higher atmosphere is the fact that at a height of five or six miles the day-to-day changes of temperature are more important than at the surface of the earth; variations of 30° F., or more, may occur with a low-level variation of but a few degrees. De Bort gives a striking example from the results of simultaneous ascents made from Paris and from Hald in Jutland. On 14th March, 1903, the temperature of the upper air over the two places at a height of about two and a half miles was the same,—about 3° F. On the following day, temperature at the same elevation over Paris had fallen about 2°; over Jutland, it had dropped to 36° below zero, a fall of about 40°; whilst the surface temperature at both places had varied but slightly. "Such facts show that we cannot theorize on atmospheric phenomena as if they were continuous in time and space; such cases, on the contrary, are rare, and limited to certain atmospheric conditions."

Lastly, it has now been demonstrated that the geographical distribution of temperature in the upper air is very different from that at the earth's surface. Surprisingly low temperatures were found at great heights over the North Atlantic, and Berson found over equatorial East Africa, at an elevation of about thirteen miles, a temperature of —119° F., "a lower temperature than ever registered at equal or even greater heights in Europe!" On the other hand, the upper-air temperatures above the Arctic Circle were found to be very high. We quote M. de Bort—

". . . In the lower layers the temperature of the equatorial zone exceeds that of the Arctic regions by 25° C. (45° F.). This excess of temperature decreases as the altitude increases until at a height of 10 or 11 kilometres it is as warm over the Arctic Circle as it is over the equatorial zone. With further increase in height there is no further decrease in temperature over the Arctic Circle, because

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* *British Association Report*, 1908, p. 594.

the isothermal region is reached. But in the neighborhood of the Equator rapid decrease of temperature with increasing altitude still continues; the temperature becomes less therefore over the Equator than it is at the same height over the Arctic Circle. . . . There are indeed some days when the polar temperatures are lower than the equatorial, but this is a temporary phenomenon which occurs at the coldest time of the year. In equatorial regions, on the contrary, if one considers as the point of departure the region where the trade-winds meet near the thermal equator, there is, strictly speaking, neither winter nor summer. . . . Thus during the greater part of the year it is sensibly colder by 10° or 20° C. in the equatorial regions at altitudes of 15 or 16 kilometres than in Arctic regions. This fact, anticipated by me some years ago, deserves to be taken into serious consideration in theories relating to the general circulation."*

The explanation of the phenomenon of the "isothermal layer" involves physical problems of great difficulty, and we can merely refer to the work of Gold† in England and Humphreys in America.‡ The latter points out that the abruptness of the change of temperature gradient at the entrance to the region of relatively warm air is probably due to the existence at the critical level of a more or less well-defined veil of cirrus cloud, and shows that when the veil is fully formed the increase of temperature is rapid, whilst with a clear sky the reversal of gradient is more gradual. As regards Gold's researches we repeat from our last issue a summary of his remarks at the Dublin (1908) meeting of the British Association, which indicates the ground covered by the paper referred to below:

"Any theory of the isothermal layer must be primarily concerned with the absorption and emission of heat radiation by the atmosphere. The streams of radiation entering any layer were four—the solar radiation, the radiation from the atmosphere above the layer, the terrestrial radiation, and the radiation from the atmosphere below the layer. If the total amount of these four streams absorbed by the layer was less than the radiation emitted, its temperature must fall, and there would be the possibility of convective equilibrium. But if the absorption exceeded the emission, the temperature of the layer would rise, and there would be no possibility of convective currents penetrating from beneath. By utilizing the experimental results of Langley, Paschen, and others to obtain an estimate of the absorptive power of the atmosphere, he had calculated the intensity of radiation entering any layer and the amount absorbed there. The application of the results to our atmosphere led to the results that, if the air were divided into two layers, the lower in adiabatic, the upper in isothermal equilibrium, the upper layer must extend as low down as 10 kilometres, where the pressure was one-quarter of that at the earth's surface, and it could not extend below 4½ kilometres, where the pressure was one-half that of the earth's surface. A further result

* *British Association Report*, 1908, p. 641.

† "The Isothermal Region of Atmosphere and Atmospheric Radiation." By E. Gold, M.A. *Proceedings* of the Royal Society, A. vol. lxxxii. pp. 43–70.

‡ "Vertical Temperature Gradients of the Atmosphere, especially in the Region of the Upper Inversion." By Prof. W. J. Humphreys. *Bulletin of the Mount Weather Observatory*, vol. ii. part 1.

obtained was that it was impossible for there to be a temperature as low as —100°C. at any point of the atmosphere."

Any student of the subject must also refer to theoretical researches made twenty years ago by M. de Bort, who calculated from the pressure and temperature at the earth's surface the isobars at a height of 4,000 metres (about 2½ miles). He showed that most of the areas of high and low pressure observed near the ground become quite effaced at higher levels, where there is a much less complex pressure distribution.*

* See *Annales du Bureau Central Météorologique*, 1887 and 1888.

September 1909.

Note.—Since the above paper was passed for press, there has been published a valuable report, communicated to the British Association (Winnipeg, 1909) by Messrs. E. Gold and W. A. Harwood, on "The Present State of our Knowledge of the Upper Atmosphere as obtained by the use of Kites, Balloons, and Pilot Balloons." The title of Advective Region is suggested for the so-called "Isothermal Layer," and M. de Bort has suggested Stratosphere as a suitable title. In contradistinction, that portion of the atmosphere below the "Isothermal Layer" would be known as the Convective Region, or Troposphere.

There will be presently published by the Meteorological Office a report on "The Free Atmosphere in the Region of the British Isles," in which Mr. Dines gives a full account of his instruments and methods, and Dr. Shaw discusses "The Perturbations of the Stratosphere."

November 1909.

THE HIGHEST BALLOON ASCENSION IN AMERICA

Dr. A. Lawrence Rotch has a short account in *Science* (No. 766) of the results of balloon experiments in our eastern states in 1908. His statement follows:

"Although a large number of *ballons-sondes* were despatched from St. Louis in 1904-7 under the direction of the writer, none had been employed in the eastern states until 1908. In May and July, that year, four *ballons-sondes* were launched from Pittsfield, Mass., with special precautions to limit the time they remained in the air and to prevent them from drifting out to sea with the upper westerly wind. Three of the registering instruments have been returned to the Blue Hill Observatory with good records. The first instrument sent up on May 7 was not found for ten months and the record,

forming the subject of the present article, is very interesting because it gives complete temperature data from the ground up to 17,700 meters, or 11 miles. This is 650 meters higher than the highest ascension from St. Louis, which, by a coincidence, was also the first one to be made there. On May 7 a general storm prevailed, so that the balloon, travelling from the east, was soon lost in the cloud and its subsequent drift could not be followed, but the resultant course was 59 miles from the southwest, as determined by the place where the instrument fell two hours later.

"At the ground the temperature was 4°.5 C., and this decreased as the balloon rose to the base of the cloud, which itself was considerably warmer than the underlying air.

"Above the cloud the temperature continued to fall with increasing rapidity up to a height of 12,500 meters (nearly eight miles) where the minimum of —54°.5 C. was registered. Here the great warm stratum was entered and penetrated farther than ever before in this country, namely, to the height of 17,700 meters, where the temperature was —45°.6 C. An increase of 10° occurred, however, in the first 3,000 meters, for above 15,500 meters nearly isothermal conditions prevailed, confirming the belief of Teisserenc de Bort that what he calls the "stratosphere" is composed of a lower inverting layer with isothermal conditions above extending to an unknown height. In an ascension last November in Belgium the relatively warm stratum was found to extend from 12,900 meters to the enormous height of 29,000 meters, or 18 miles, where there was still no indication of its diminution."

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

MEETINGS OF THE SOCIETY. A special meeting of the Society was held on Monday evening, Dec. 6, 1909, at the Engineering Societies Building, when Commander Robert E. Peary, U. S. N., delivered an address on "The Discovery of the North Pole." The Hall was crowded and many were unable to gain admittance. President Huntington, in introducing the explorer, said:

"It is my great privilege this evening to introduce to you, not alone the man whose unwearied efforts have so wonderfully broadened our knowledge of the world, but the man who by his own choice and the sacrifice of the best he had to give—the years of his life—becomes for us a type and expression of our own aspirations. The endeavor of Commander Peary is a demonstration in an individual of the idealism of our race; that eager willingness to face all chances that the sign manual of humanity may be placed on the outermost edge of the

humanly attainable. Such work is a vindication of immortality—a defiance to time."

Commander Peary showed a large number of lantern views illustrating his last expedition, from the passage of the *Roosevelt* through the Smith Sound Channels to its winter quarters at Cape Sheridan, the sledge route to Cape Columbia which was the starting point for the journey of 475 statute miles to the North Pole, and many phases of the eventful march over the sea ice, such as hauling the sledges across the pressure ridges, the ice huts at the camps, the method of taking observations for position, ice scenes at the Pole, etc. His address was the condensed story of the great achievement which, as he said, was the result of the perfected organization, methods and material growing out of many years of experiment and study.

A regular meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday evening, Dec. 21, 1909. Vice-President Greenough in the chair.

The following persons, recommended by the Council, were elected to Fellowship:

Frank Bailey,
John L. Cadwalader,
Ramon Cuiteras,
Alfred W. Hoyt,
Charles P. Huntington,
Jesse Albert Locke,
James Marwick,
Eugene Meyer, Jr.,
Charles L. Parmelee,
Charles W. Parsons,
William L. Porter,
Rev. Philip M. Rhinelander,
Thomas Shaw Safe,
Charles W. Seabury,
Dr. Louis Livingston Seaman,
Jefferson Seligman,
Morris W. Seymour,
Miss Anna Riker Spring,
James Gordon Steese,
R. F. Warner.

The Chairman then introduced Professor Charles Ernest Fay of Tufts College, who addressed the Society on "Across Uganda to the Mountains of the Moon." Stereopticon views were shown.

On motion, the Society adjourned.

Honors Awarded. At a meeting of the Council of the Society, on Dec. 16, the Cullum Medal was awarded to Mr. Ernest H. Shackleton, the Antarctic explorer, who, on Jan. 9, 1909, after a long journey southward over the Barrier Ice and the Antarctic continent, reached a point within 97 geographical miles of the South Pole.

At the same meeting, the Council awarded the Daly medal to Mr Charles Chaillé-Long, who, in 1874, navigated the Victoria Nile, discovered Lake Ibrahim and completed the proof that the river issuing from Victoria Nyanza is the Nile.

NORTH AMERICA

Relief Model of Illinois. The Geological Department of the University of Wisconsin has prepared a geological relief model of Illinois for the University of Illinois. Its horizontal scale is five miles to an inch and vertical scale, 1,320 feet to one inch. The model is six feet seven inches by three feet nine inches. The topography is based upon the contour maps prepared in 1892 under the direction of Prof. C. W. Rolfe for the Chicago World's Fair and upon the

topographic maps of the United States Geological Survey, the Mississippi River Commission, etc. The geology is mostly from the geological map prepared by Prof. Stuart Weller for the Illinois Geological Survey.

The Geologic Map of North America. The Geological Society of America, at its meeting in Ottawa, in 1905, appointed a committee to prepare a general geological map of North America. The committee consisted of the late I. C. Russell (chairman), J. G. Aguilera, Bailey Willis, F. D. Adams, and C. W. Hayes. The completed map and two explanatory pamphlets by Messrs. Willis and Aguilera were presented at the meeting of the Tenth International Geological Congress held in the City of Mexico in September, 1905. Though the map was criticised in some respects, it was the first adequate step towards the filling of a long-felt want, and the map has served a very useful purpose. The U. S. Geological Survey has recently been revising the map with a view to republication, and the preliminary draft of the new map is now ready for inspection, by all who are interested, at the office of the Survey in Washington.

State Geological and Natural History Survey of Connecticut. The Third Biennial Report (Bull. 12) recapitulates what has been done, the work in progress and the future work in geology. The two subjects of investigation are the geology and the natural history (botany and zoölogy) of the State. The geological investigations relate chiefly to surface geology or the study of the phenomena connected with the work of the great ice sheet of the Glacial period. Apart from the problems of surface geology, the area most thoroughly studied is that of the Triassic formation. The area where detailed work is most deficient, as yet, is that of the eastern crystallines. But there is more necessity, at present, for the more detailed study of the surface geology than that of the underlying rocks.

Tide Tables for the Eastern Coasts of Canada for 1910. These tables prepared by Dr. W. Bell Dawson have been issued by the Tidal and Current Survey, Department of Marine and Fisheries, Ottawa. The data on which the tables are based have been obtained by means of self-registering tide-gauges that are constantly in operation. As these observations have been kept up for a long time, it is found that the tables deduced from them are sufficiently accurate to be very useful. The records of the tide-gauges are reduced by the latest methods of obtaining the tidal constants, and from these the tables are calculated by the Nautical Almanac Office in London.

SOUTH AMERICA

The Tunnel Across the Andes. The *London Times* says that this tunnel was broken through in the last days of November and that by March it is expected to run trains between Buenos Aires and Valparaiso. The tunnel will be about three miles long, with the summit level of the railroad about 10,460 feet above the sea. The works at the Argentine end were begun in October, 1905, and the Chileans began their end of the tunnel a little earlier. The enterprise has been carried on under much difficulty owing to the nature and position of the rock. The tunnel was driven through the top of the mountain, which is composed of stratified rocks, tilted at a high angle, with some of the strata almost vertical. Owing to the constant percolation of melting snow, the rocks are decomposed to a great distance below the surface, especially along the planes of stratification and in fissures.

The rocks through which the eastern half of the tunnel was cut are chiefly limestones with beds of gypsum, layers of sandstone, some narrow clay bands, as if along the line of faulting, and some beds of conglomerate full of very hard, rounded water-worn pebbles and small boulders. Especially near the eastern end of the tunnel all joints and fissures are so decomposed that the rocks were found to be very loose.

Quite different conditions were found at the western end. The rocks there are mainly felspathic, with hard, tough clay in veins. These rocks endure much better than those of the eastern side, though they have many joints and cleavage planes. The western side of the mountains has the steeper slope and the rocks are much more solid. It was necessary, however, to line the tunnel throughout, for, though many of the rocks may in themselves stand the extremes of heat and cold, no dependence can be placed on any of the cleavage planes.

THE HEIGHT OF MOUNT HUASCARAN. Mrs. Fanny Bullock Workman has sent information to the press that in July last she despatched M. de Larminat and two other competent French topographers from Paris to Mount Huascaran, Peru, one of whose twin peaks was ascended in 1908 by Miss Anna Peck. They were to make scientific determinations of the height of these peaks. Mrs. Workman adds:

"They executed a careful and detailed survey from the sea to Yungay, and by actual measurement established the heights of four stations in the Black Cordillera, from each of which they triangulated the two peaks of Huascaran.

"The results are: Height of north peak, 21,812 feet; of south peak, 22,187 feet. These figures may vary by a few feet, but not many, when the calculations are finally gone over by M. Vallat for verification. Mount Aconcagua, nearly 22,900 feet, still remains, as I predicted, and as Sir Martin Conway and other Andean explorers have always maintained, the highest peak of South America."

AFRICA

DR. PÖCH'S STUDIES AMONG THE BUSHMEN OF SOUTH AFRICA. The Society has received a letter from Dr. R. Pöch announcing that he has finished his travels in the Kalahari and his studies of the Bushmen tribes. His researches were made under the auspices of the Imperial Academy of Science of Vienna. In 1907, he went to German Southwest Africa and reached the Kalahari Desert *via* Windhuk and Gobabis. The whole of 1908 was spent in "trekking" by ox wagon through the Kalahari, from west to east. At five points he stopped from three weeks to three months. Four different tribes were thoroughly studied: the Heillum, Aullein, Ai-khoe, and Ohê-khoe.*

Measurements, photographs, phonographic records, and cinematographic pictures were taken. The Kalahari Bushmen in their daily life and customs still exhibit the characteristics of their fathers, but in physical appearance they show their relationship to the Negro and the Hottentot. Some of their languages are closely related to that of the Hottentots.

The first half of 1909 was given to studies of the last remnants of the Cape Bushmen (Kham tribe), which is a much purer representative of the genuine Bushman, but is now almost extinct.

Dr. Pöch finished his researches with a second journey in the Kalahari.

* These names are not spelled here, according to Dr. Pöch's transliteration, as he employs some specially designed characters.

Starting from Upington on the Orange River, he crossed the sand wastes to the north in different directions, reached Kuis in the Molopo Valley and travelled up the Nosob Valley nearly to the German border. South of the Molopo, he found the Nu, who are closely related to the Cape Bushmen. His journeys in the desert covered more than 2,000 miles and stretches up to 200 miles were crossed without water, men and animals quenching thirst only on watermelons. He is now at his home in Vienna, working out his materials.

ASIA

Discoveries by Dr. Longstaff. The recent expedition of Dr. Longstaff in the Himalaya made important discoveries which are reported in the *London Times* (Weekly edition, Dec. 24, 1909). He made for the Saltoro Pass, in the Karakoram, because he knew that the main axis of this western part of the Himalaya had never been crossed by any traveller between Younghusband's Mustagh Pass and the Karakoram Pass itself, a distance of 100 miles in a straight line. The name Saltoro Pass has been handed down by tradition, but there is no record of any one having crossed it and its exact position was uncertain.

When he and his companions crossed this pass (18,200 ft.), on June 15 last, they saw before them a huge glacier, bounded to the north and east by a lofty range of snowclad peaks. They found that this glacier was flowing south, though represented on the maps as flowing north. In September, Dr. Longstaff returned to this Siachen glacier (Saichar on the maps) and found it to be 44 miles long, instead of some 20 miles as had been supposed. It pierces the range that has hitherto been regarded as the main Karakoram axis.

The Siachen is thus shown to be the largest glacier in the Himalayan system and probably the largest outside the Alaskan and Polar regions, its only competitor being the Inytchek glacier in the Tian Shan. As the Siachen glacier drains into the Nubra River, the basin of the Indus must extend much further north than had been supposed. In short, the Indus-Yarkand water-parting here follows a chain of mountains not shown on any maps and some 20 miles north of the high range upon which it has been hitherto located.

Another very interesting discovery was that of a group of lofty peaks crowning this new chain of the Karakoram and culminating (about 35° 30′ N. Lat.; 70° E. Long.) in Teram Kangri, 27,610 ft. If the explorer's measurements can be accepted, this new peak is over-topped only by Mount Everest, K2, Kinchinjunga and Makalu.

POLAR

Peary's Attainment of the North Pole. On Nov. 3, 1909, the Sub-committee of the Research committee of the National Geographical Society, Washington, reported that it had carefully examined Commander Peary's original journal, records of observations, instruments, etc., and was "unanimously of the opinion that Commander Peary reached the North Pole on April 6, 1909." A gold medal was awarded to him and another to Capt. Bartlett, the navigator of the *Roosevelt*.

Decision Adverse to Dr. F. A. Cook's Claim. The Committee appointed by the University of Copenhagen to consider the evidence upon which Dr. F. A.

Cook rested his claim that he had attained the North Pole on April 21, 1908, reported that the documents which he submitted afforded no proof that he had been to the North Pole.

CAPTAIN ROBERT F. SCOTT'S ANTARCTIC EXPEDITION. The British Government has promised $100,000 towards this projected expedition. About $60,000 has been raised by subscription and Capt. Scott says there is no doubt that the remaining $40,000 required will be obtained.

He expects to start south this summer and, in January or February next year, establish two bases on the Barrier Ice whose northern edge forms the Great Barrier Wall. One of these bases will be at South Victoria Land and the other at King Edward VII Land, about 450 miles apart. Each of these bases will be about 850 statute miles from the South Pole, and from them it is expected to make an extensive examination of the Barrier Ice; also, from one or another of them to make the journey to the Pole. Capt. Scott says that motor sledges and others drawn by ponies and dogs will be used on the south polar journey. He has sent to Siberia for dogs and ponies. In his final march for the Pole, he expects to have sixteen men with him. He will take supplies for three years, and, even if he reaches the Pole in the first season, he expects to spend the summer of 1911-12 in further explorations.

CLIMATOLOGY

EARLY CIVILIZATIONS IN EUROPE AND AMERICA. In his inaugural lecture as Kaiser Wilhelm Professor at Columbia University (published in *Science,* Feb. 26, 1909, and the *Scot. Geog. Mag.,* July, 1909), Professor Albrecht Penck brought out, in an interesting manner, some of the larger facts regarding the early civilizations of Europe and America in relation to climatic controls. European civilization, there is no doubt, had its origin in the Orient. In Mesopotamia and Egypt an early civilization arose under arid and semi-arid conditions, based on irrigation, and this civilization was spread by the early navigators over the whole Mediterranean basin, where it everywhere found congenial conditions. In America the conditions under which early civilization was developed on the Mexican plateau were in many respects similar to those in the Orient. But the Mexican civilization was more feeble, and it could not extend in the same way. The American Mediterranean is much larger than the European, and early navigators did not find here the same landmarks which made it possible for the Phœnicians and the Greeks to sail so far. Furthermore, the shores of the American Mediterranean were not as inviting to settlers as those of Greece, Italy, Spain or northern Africa, for the former are covered widely with forests, dense and penetrable only with great difficulty. In fact, a belt of these virgin forests hindered the Mexicans from extending their civilization down to the Gulf of Mexico. The Gulf has, therefore, never played a rôle like that of the Mediterranean. The forests of peninsular North America were far out of reach of the original American civilization, which could not spread over the shores of the American Mediterranean, nor across the arid regions and deserts north of Mexico. Thus the Indian inhabitants remained here in the state of hunters, and did not clear the woodland. It was only after European settlers came, who had learned in Europe to overcome the resistance of forests to agriculture, that the natural riches of the forested area of North America were developed. R. DEC. W.

OBITUARY

Col. George Earl Church. This well-known civil engineer and geographer died in London, on Jan. 5, aged 74 years. He possessed probably a wider and more complete knowledge of the history, the geography, and the resources of tropical South America than any other authority. For many years he travelled extensively in the heart of the continent, and the information thus acquired was supplemented by a life-time of study of the experiences of other travellers, both past and present. By birth a citizen of the United States, Col. Church resided during the later years of his life in London. He was president of the Geographical Section of the British Association in 1898 and was long active as a member of the Council of the Royal Geographical Society and as a contributor to its *Journal*.

PERSONAL

Professor William M. Davis lectured before the Geological department of Colgate University on Dec. 20. His subject was "The Italian Riviera Levante."

Professor R. E. Dodge of Teachers College, Columbia University, lectured at the University of Wisconsin on Wednesday, Dec. 1, on "The New Movement in Secondary School Geography."

Dr. John M. Clarke, State Geologist of New York, has received the honorary degree of Doctor of Science from Colgate University.

At the annual banquet of the Geographic Society of Chicago on Jan. 26, the Helen Culver gold medal of the Society was presented to Prof. Thomas C. Chamberlin and also to Commander Robert E. Peary, U. S. N.

Mr. Shackleton, the Antarctic explorer, has been created a Knight by King Edward VII. Since his return from the Antarctic, he has also received many of the highest honors conferred by geographical societies.

Prof. William H. Holmes on Jan. 1 severed his official connection with the Bureau of American Ethnology and resumed his place as head curator of anthropology in the U. S. National Museum. He also becomes curator of the National Gallery of Art. His preference has always been for museum work.

Mr. F. W. Hodge on Jan. 1 entered upon his duties as chief of the Bureau of American Ethnology. The position, being vacated by Prof. W. H. Holmes, naturally falls to Mr. Hodge on account of his many years of intimate acquaintance with its operations.

Prof. Dr. Penck of Berlin and Prof. Dr. Partsch of Leipzig have been elected corresponding members of the Academy of Sciences in Munich.

Dr. Karl Sapper, Professor of Geography at the University of Tübingen, has been invited to take the chair of Geography in the University of Strassburg as successor to Prof. Dr. Gerland.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Camp-Fires on Desert and Lava. By William T. Hornaday, Sc.D. xxi and 366 pp., 2 Maps, many photographic Illustrations, 6 colored Plates, and Index. Charles Scribner's Sons, New York, 1908. $3.

All who have read Dr. Hornaday's work entitled "Camp-Fires in the Canadian Rockies" will heartily welcome this new book from his pen. It fully maintains the high standard he established in his earlier work. It successfully combines qualities of superior excellence which, too often, fail to mark writings on geography, botany, zoology and sport. These several topics are all prominent in the book; and though it contains so much solid and important information, the whole is presented in a way to interest and edify all intelligent readers.

The work describes a region in southern Arizona that was very little known and the large Pinacate district in northern Mexico which was practically a *terra incognita*. The whole is a story of desert life and conditions. It was a winter exploration, for it is folly to explore deserts in hot weather; and in November, Dr. Hornaday found southern Arizona fascinating in its boundless space, glorious sunshine and balmy air. The face of nature was clean, and there was utter escape from the dirt and pollution that wear on human life in the great cities.

In Dr. MacDougal, John M. Phillips and Godfrey Sykes, the author had most valuable assistants, and their contributions to this volume add much to its worth. Mr. Sykes made the first map of the Pinacate region, and his first sketch of the map appeared in the *Bulletin* (Vol. 40, p. 708) to illustrate an article by Dr. MacDougal on the geography of the lands described in this book. The photographs are excellent and the colored plates are especially fine. The work is an important contribution to our knowledge of one of the least known parts of North America.

The Rockies of Canada. A Revised and Enlarged Edition of "Camping in the Canadian Rockies." By Walter Dwight Wilcox. Third Edition. ix and 300 pp., Map, over 40 Photogravures and other Illustrations from original photographs by the author, and Index. G. P. Putnam's Sons, New York, 1909. Price, $5.

The Canadian Rockies are growing every year in popularity, and governmental and private enterprise are making them much more accessible as a pleasure ground. The result is that nearly every year supplies something new about them. In the present edition of this work a considerable part of the text has been rewritten and nearly half of the steel plates are new. The illustrations are probably the best that have yet appeared in any work relating to these moun-

tains. They are the result of long effort to secure perfect pictures from the loveliest and grandest places among these snow-capped peaks. This excellent book together with the Canadian governmental and private publications on the neighboring Selkirks afford the literary material needed by the throngs that visit those regions.

The Copper Resources of California. Issued by the California State Mining Bureau under the Direction of Lewis E. Aubury. 366 pp., Maps, Illustrations, Appendix, and Index. W. W. Shannon, Superintendent State Printing, Sacramento, 1908.

This report was first published in 1902. Since then the development of copper mining in California has been very large. The publication has been brought up to date and supplies much information on the development of this industry in the past six years. Practically all the copper prospects and mines are described. The illustrations are good and a number of maps help the text.

What the White Race may learn from the Indian. By George Wharton James. 270 pp. and Illustrations. Forbes & Co., Chicago, 1908. $1.50.

Well illustrated and interesting, this very readable book still cannot claim much space in a specifically geographical publication. It belongs to a kind of literature that might be termed popular ethnography with an inclination to polemics. It also caters to a tendency of great benevolence towards the Indian. The red man and the white man are constantly confronted and contrasted, and in the course of this process the author finds occasion to tell many interesting facts in the shape of descriptions of Indian customs and also to state a number of truths not complimentary to the white man, but none the less true. The author confines his field of operation to the United States and is careful not to generalize too much. It is evident that not everybody will agree with him, and that even those who in the main support his ideas and opinions will dissent from them on various points; but everybody who takes an interest in the question will be glad to read the book. The work is worthy of commendation in a general way and hence creditable to its author both through its text, general make-up and pictures.

A. F. Bandelier.

The South Americans. By Albert Hale. 361 pp., with numerous Maps and Illustrations. The Bobbs-Merrill Co., Indianapolis, 1907. $2.50.

This work bears the sub-title which is explanatory, "The story of the South American Republics, their characteristics, progress and tendencies; with special reference to their commercial relations with the United States." It is dedicated to Secretary Elihu Root, the "one great statesman of recent years who has understood the Latin temperament . . ." The author repeatedly implies and positively states his lament that there are so few North Americans who have a just appreciation of their South American neighbors or of the mutual profit to be derived from a more intimate acquaintance, the one with the other. Mr. Hale writes as one who knows his subject from long acquaintance with it. He tells us that he has known South America for twenty-five years through intimate association, extended residence and the experiences of travel. The book does not purport to be an exhaustive study of Latin America. It reads now like a travel narrative, now like a statistical record, social, political, educational, economical. Com-

parisons are frequent, and the ideas thus suggested are elaborated and fully explained.

In the moral sense he finds the Latin American inferior to the "Yankee," which last expression he tells us is a dignified word in both Spanish and Portuguese. In the artistic sense the advantage is with the South American. He has no special word of condemnation for the business methods of the North American save as these methods touch trade relations with the south. Here he finds two great mistakes. "One is the lack of comprehension of what those people require, the other is the unwillingness to persevere in efforts to secure trade." It is clearly the author's intent to make plain that there is wanting a helpful sympathy between north and south.

In the main it is the Atlantic and the Caribbean Sea states which are discussed, and this under the general chapter analysis of Geography, History, Government, the People and their present conditions.

The concluding chapters deal with "The South American Situation," which is an attempt at a summary, and with the "Monroe Doctrine," which the author refers to, with much point, as the political romance of the nineteenth century, for who can give it clear and accurate definition? To the end that honesty and fair dealing may be upheld, it is urged that the position of the United States should be clearly stated. E. L. STEVENSON.

Wanderings in South America. With Original Instructions for the perfect preservation of Birds, etc. By Charles Waterton. Including a Memoir of the Author by Norman Moore and an Introduction by Charles Livingston Bull. xxvi and 338 pp., Illustrations and Index. Sturgis & Walton Company, New York, 1909. $2.50.

This reprint of Waterton's book deserves attention. His travels in British Guiana, the north-west of the United States and the Antilles occupied most of his time between 1812 and 1824. His excessive modesty is shown in his preface to the first edition, where he says that his book "has little merit and must make its way through the world as well as it can." The book is, in fact, a classic. Its author was a born naturalist and wrote of nature with love and enthusiasm. The practical instructions as to the method of collecting and preserving specimens, which Waterton gave, have been of great benefit to other wanderers in tropical regions. He tells nothing of personal difficulties and discomforts, gives no information of the guide book kind, but all his pages are filled with his observations of birds and beasts and their environment in the tropical forests.

Zwei Jahre unter den Indianern. Reisen in Nordwest-Brasilien, 1903-1905, von Dr. Theodor Koch-Grünberg. Erster Band. iv and 359 pp., Map from original surveys of the author, 227 Illustrations and 12 Plates. Ernst Wasmuth, Berlin, 1909.

Dr. Koch-Grünberg was the first explorer to visit some of the extreme upper tributaries of the Rio Negro. Accomplished in most phases of geographical work, he has described this unknown region and made the first map of its rivers and of the distribution of its Indian tribes. The publication of the results of his scientific work and of his superb plates illustrating the various tribes has preceded the appearance of the present volume and attention has been called to them in the *Bulletin* (Vol. 38, p. 376; Vol. 39, p. 296; Vol. 40, p. 227; and Vol. 41, p. 706). Altogether, he has published 14 monographs and papers on his fruitful

two years' work. A list of them appears in the preface to this handsome volume, which tells the history of his explorations and describes its results for the general reader. The book is handsomely produced and illustrated, and is one of the best contributions of the past year to geographical literature.

The Frontiers of Baluchistan. Travels on the Borders of Persia and Afghanistan. By G. P. Tate. With an Introduction by Col. Sir A. Henry McMahon. xvi and 261 pp., 2 Maps, 37 Illustrations, and Index. Witherby & Co., London, 1909. 12s. 6d.

Few persons are more familiar with northern Baluchistan and the adjacent portions of Afghanistan and Persia than Mr. Tate. Much of his life has been devoted to surveys for the Indian government on the northwest frontier of India, and he has made three protracted journeys from the Indus to Persia and back. During his last journey, as a member of Sir Henry MacMahon's Boundary Commission from 1902 to 1904, he spent more than two years in the unique basin of Seistan, near the corner where Persia borders upon Afghanistan and Baluchistan. In view of Mr. Tate's familiarity with the country, one takes up his book with lively expectations of finding a solution of some of the great problems which centre around Seistan. In scarcely a single case are such expectations gratified. The book is arranged for the most part according to the strict sequence of the author's journeys, with the natural result that a given subject is treated briefly in various places, and the reader fails to get the full benefit of what is actually stated quite fully, and the difficulty is increased by the sketchy and parsimonious character of the two maps. To take a subject of minor importance as an illustration, the book contains a large amount of really valuable and interesting information as to camels and their ways; but diseases are treated briefly in two or three different places, capacity for loads in another, and relation to moisture, ability to endure thirst, methods of native surgery by means of a heated sickle, ferocity during the mating season, the character of albinos, etc., in still other places.

One of the best features of the book is its descriptions of desert scenery and colors, somewhat minute and detailed, to be sure, but giving a vivid idea of the beauty of the desert at certain times. Another good point is the vivid picture of the difficulties of life in the desert, the bitter cold during the windy days of winter, and the burning heat and thirst of summer. The horrors of Seistan, its blighting summer winds, its water-logged condition in spring, its mad wolves, one of which bit 78 camels in one night, and its poor oppressed inhabitants,—all these are treated with more or less fullness. A good deal of space is given to the Wind of 120 Days, which blows with extraordinary violence and steadiness all summer. Its influence upon architecture, vegetation and insect life are well portrayed. The same may be said of certain native habits as to trade, land tenure, and official methods.

Mr. Tate carefully refrains from theorizing in most cases. In regard to the terraces surrounding the Lake of Seistan, however, he departs from this rule and briefly sets forth the theory that they are due to subsidence of the bottom of the lake. Such a theory goes directly counter to the conclusions of Gilbert and Russell, and many others, as to similar phenomena in lakes Bonneville and Lahontan, where the old terraces appear to be lake strands due to changes of climate. Tate, however, does not even mention this theory, and leaves the reader to conclude that the subsidence theory is the only possible explanation.

To most readers the subjects of greatest interest in Seistan are the truly wonderful number of ruins and the present political situation. The ruins are mentioned frequently by Mr. Tate, but are nowhere described in such a way as to give any adequate idea of how they look, by whom they were occupied, and especially why they were abandoned and the land left desolate. To-day the population is estimated at 160,000 people, before the days of Tamerlane at 250,000, and previous to that it must have been much greater. It would be hard to find a subject of greater interest than the cause of this change, but our author scarcely touches the matter.

The reason for the long sojourn of the British Boundary Commission in Seistan was that the Helmand River, like all other streams, builds up its flood plain in the immediate vicinity of the river, and thereby causes its own course to shift to one side or the other. Inasmuch as Seistan is the only place for hundreds of miles where water is available, it is peculiarly valuable to both Afghans and Persians. The river was supposed to be the boundary between the two nations, and when it changed its course, there naturally arose a bitter dispute. If Mr. Tate could have explained the variations in the river's course and told us how they have influenced the people of Seistan directly and the political relations of Persia and Afghanistan, and of England and Russia indirectly, he could have written a book of great general interest and of high geographic value. In fairness to him a word of explanation should be added. For some reason, implied but not stated, he has not felt himself free to enter into a discussion of many of the most interesting problems connected with his work. He refers again and again to the vast amount of data collected by the Commission as to all manner of subjects, but fails to satisfy the thirst for information that he thus arouses. Presumably, the data are all embodied in official reports. Apparently, Mr. Tate knows a great deal which the world would also like to know, but which he has not deemed it best to tell. ELLSWORTH HUNTINGTON.

La Patria. Geografia dell' Italia. Opera compilata dal Prof. Gustavo Strafforello. Provincia di Torino. Seconda edizione interamente riveduta e ampliata a cura del Cav. Giuseppe Isidoro Arneudo. iv and 736 pp., Maps of the Province and City of Turin, 204 Illustrations and Index. Unione Tipografico-Editrice Torinese, Turin, 1907.

This large work is a detailed account of Turin Province, dealing with its history, geography, products, industries, commerce, educational work, arts, monuments, public edifices, benevolent institutions, etc. The theatres, libraries, prominent engineering works and other phases of the Province come in for description and copious illustration. The many pictures from photographs are good, though not produced in a superior manner. Few books about a small part of the world are packed with more information.

Tevere. Nuova Edizione riordinata e ampliata con Atlante. Memoria 26 *bis* della Carta Idrografica d'Italia. xii and 486 pp. Ministero di Agricultura, Industria e Commercio, Rome, 1908. L. 6.

A thorough revision and enlargement of the earlier Memoir on the Tiber River published in 1898. It is accompanied by an atlas showing all phases of the river and its basin. This is the latest of a series of exhaustive Memoirs on the hydrography of Italy which the Government began to publish in 1888. The

series now numbers 36 volumes, and it is of the first importance in the study of all economic questions in which the water resources of the kingdom are involved.

Anmerkungen über Levkas. v and 61 pp., and Illustrations. Heinr. Mercy Sohn, Prague, 1903.

A folio, finely produced and containing several superb colored plates. It describes the little island and town of Levkas, among the Ionian Islands, and is a bit of excellent geographical writing about a small land area that has recently come into considerable notice. This is the island which Prof. Wilhelm Dörpfeld and some other archæologists maintain is identical with the Homeric island of Ithaca, the home of Ulysses. There are others who hold to the faith that the ancient Ithaca was the island that is now known by that name. The literary warfare over this question has resulted in a number of books, with the result that Levkas has become one of the best described, mapped and pictured among the small Greek islands. The unnamed author of the present work does not share the belief of Prof. Dörpfeld, but his book is the most sumptuous volume that has been given to the island. He has left scarcely any thing untouched in the lines of descriptive and human geography, and his pictures of the coasts and of bits of the interior are works of art. He spells the name "Levkas," which is the official, modern Greek spelling, though we as often see it "Leucas."

La France et ses Colonies au début du XXe Siècle. M. Fallex and A. Mairey. vi and 660 pp., Maps, Illustrations, and Index of Place Names. Librairie Ch. Delagrave, Paris. Price, 5 frs.

This is one of the superior geographies recently issued by Delagrave which have already been noticed in the *Bulletin*. It is a fine example of descriptive and synthetic geographical treatment. A good feature is the summary of the contents of each chapter at its opening. The numerous photographic reproductions, diagrams, and maps are excellent.

Feinnivellement des Rheins von Mainz bis zur Niederländischen Grenze. xvi and 177 pp., and 1 Table. Bureau für die Hauptnivellements und Wasserstandsbeobachtungen im Ministerium der öffentlichen Arbeiten. P. Stankiewicz's Buchdruckerei, Berlin, 1908.

This work records the levelling operations on both banks of the Rhine between Mainz, the practical head of navigation for steamboats, as far north as the Netherlands boundary. Many hundreds of exact elevations above the sea were secured along both banks of the river. The methods of the work are described in the introduction. Between 1892 and the present time the German Ministry of Public Works has published over thirty volumes giving the results of similar observations along the banks of the more important rivers in Germany.

The Cadastral Survey of Egypt, 1892-1907. By Captain H. G. Lyons, Director-General. viii and 421 pp., Maps, Plans, Illustrations, 5 Appendices, and Index. National Printing Department, Cairo, 1908. Price, 400 milliemes.

The cadastral survey of Egypt, begun in 1892 as a survey of State lands, developed into a revenue survey in 1896, and became soon afterwards a cadastral survey carried out with technical accuracy and comparable with similar surveys in Europe. The whole of the cultivable lands of Egypt, except the distant oases,

were surveyed, and land registers, recording the area, and ownership of each property, were prepared. One-third of the country was mapped on the scale of 1:4,000, two-thirds, including all the more fertile districts, on the scale of 1:2,500 and nearly all these maps have now been published. The cadastral survey has been completed, and the present report records in considerable detail the progress and methods of the work with statistical information that may be instructive to surveyors, both in Egypt and elsewhere. The maps, diagrams, and other illustrations are numerous.

Il Ruwenzori. Parte Scientifica. Risultati delle Osservazioni e Studi compiuti sul Materiale Raccolto dalla Spedizione. Two Vols. Vol. I. Zoologia. Prof. L. Camerano and others; Botanica. Dott. E. Chiovenda e Cortesi and others. vii and 603 pp., and 74 pp. of Illustrations; Vol. II. Geologia. Prof. A. Roccati; Petrografia e Mineralogia. Prof. A. Roccati, Prof. Luigi Colomba and Prof. G. Piolti. xix and 286 pp., Geognostic Map of Uganda, and 40 pages of Illustrations. Ulrico Hoepli, Milan, 1909. Price, 50 Lire.

Very few societies could afford the sum for the printing of scientific results that the Duke of the Abruzzi has expended on these two sumptuous volumes. The collections made by his expedition to the Ruwenzori Mts. were placed in the hands of Italian specialists. Thirteen of them worked out and describe, in Vol. 1, the zoological results. The botanical work was distributed among eight scholars. Vol. 2 gives 164 pp. to geology and the text concludes with the discussion of the petrographic and mineralogical results. The first volume adds considerably to our knowledge of the natural history and botany of the western part of British East Africa and the second is one of the most important contributions yet made to the study of the geology of Equatorial Africa. The numerous plates have rarely been equalled in African photography.

Die Weltumsegelungsfahrten des Kapitäns James Cook. Ein Auszug aus seinen Tagebüchern. Bearbeitet und übersetzt von Dr. Edwin Hennig. 554 pp., 1 Map, and 8 Illustrations. Gutenberg-Verlag, Hamburg, 1908. Price, M. 6.

An excellent selection of material from Capt. Cook's own story of his famous voyages and discoveries. This is Vol. 1 of the "Bibliothek denkwürdiger Reisen" which is being issued under the editorship of Dr. Ernst Schultze. Dr. Hennig has made a good translation and his selections give an idea of the great explorer's contributions to geographical knowledge. The readable character of the English narrative is well preserved.

Kulturpflanzen der Weltwirtschaft. Unter Mitwirkung erster Fachleute herausgegeben von Otto Warburg und J. E. van Someren Brand. xiv and 411 pp., 653 Photographic Reproductions and 12 Illustrations in Colors. R. Voigtländers Verlag, Leipzig. Price, 20 Marks.

One of the best books that has been given to the exposition of agricultural industries. The work describes the cultivation and preparation for market of rice, wheat, maize, sugar, wine, coffee, tea, cacao, tobacco and cotton. In the chapter on tobacco, for example, the history of the plant and of its distribution is given and the phases of production, and manufacture in various countries are

depicted in text and illustrations. The chapter gives a comprehensive view of the importance of tobacco in all countries where it is produced, manufactured and consumed. The text is intended for all intelligent readers and its interest is emphasized by the extraordinary number of photographic reproductions and of pictures in colors, one or more of which appear on every page. Mr. Warburg, one of the editors of the work, is well known as an authority on tropical agriculture and the editor of *Der Tropenpflanzer,* Berlin.

Text-Book of Petrology. By F. H. Hatch. Fifth Edition. xvi and 404 pp. and Illustrations. Swan, Sonnenschein & Co., London, 1909. $1.90.

The fifth edition of this text-book on the petrology of the igneous rocks has been so much enlarged that it contains, approximately, three times as much material as the first edition which appeared eighteen years ago. With its more numerous illustrations, more complete lists of chemical analyses, and fuller references to the literature of petrology, the present edition deserves to be classed among the best of the smaller text-books on the subject.

The author divides the book into four parts, the first of which deals with "the physical characters of the igneous rocks." The modes of occurrence of igneous rocks are described briefly under such paragraph headings as Stocks, Dykes, Laccoliths, Necks, etc.; columnar and other types of joint structure, flow structure, and other features of "External structure" are treated in a short chapter; while texture or micro-structure, and composition, both chemical and mineralogical, receive a more extented treatment in the two following chapters.

Part II deals with "the constitutent minerals of the igneous rocks," discussing several bases of classification and presenting in the first chapter in tabular form, a classification of the more important minerals. In the second chapter certain optical properties of minerals as seen in thin sections are discussed; chapter three is devoted to the detailed description of the rock-forming minerals.

Part III considers "the classification of igneous rocks" under the three chapter headings: Plutonic Rocks, Hypabyssal Rocks, and Volcanic Rocks. Further classification is based on the silica content, with the alkali and calc-alkali contents as a basis for still further subdivision. In Part IV the "distribution of the igneous rocks as illustrated by the British Isles" is treated in three chapters, while a table for the determination of rock-making minerals in thin sections, by R. H. Rastall and J. Romanes, is given in an appendix. D. W. Johnson.

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Quad., 1:250,000, interval 50 ft. *New Mexico:* Santa Rita Special Map, 1:24,000, interval 20 ft.; Silver City Quad., 1:125,000, interval 100 ft. *New York:* Cooperstown Quad., 1:62,500, interval 20 ft. *North Carolina:* Coharie Quad., 1:62,500, interval 10 ft. *Ohio:* Alliance Quad., 1:62,500, interval 20 ft. *Ohio-Penn.:* Columbiana Quad., 1:62,500, interval 20 ft. *Oklahoma:* McAlester Quad., 1:125,000, interval 50 ft. *Oklahoma-Missouri-Kansas:* Wyandotte Quad., 1:125,-000, interval 50 ft. *Pennsylvania:* Freeport Quad., 1:62,500, interval 20 ft. *South Carolina-North Carolina:* Gaffney Quad., 1:62,500, interval, 20 ft. *Tennessee:* Franklin Quad., 1:62,500, interval 20 ft. *Tenn.-Ga.-N. C.:* Ducktown Special Map, 1:36,000, interval 20 ft. *Utah:* Strawberry Valley Quad., 1:125,000, interval 100 ft. *Washington:* Seattle Special Quad., 1:62,500, interval 25 ft. *West Virginia:* Charleston Special Quad., 1:62,500, interval 50 ft.; Clendenin Quad., 1:62,500, interval 50 ft.; Elkins Quad., 1:62,500, interval 50 ft.; Midkiff Quad., 1:62,500, interval 50 ft.; St. Albans Quad., 1:62,500, interval 50 ft.; Wayne Quad., 1:62,500, interval 50 ft. *Wisconsin:* Oconomowoc Quad., 1:62,500, interval 20 ft.; Sparta Quad., 1:62,500, interval 20 ft.

COLORADO. Pleistocene Geology of the Leadville Quadrangle, Col. 1:125,000=1.9 mile to an inch. By Stephen R. Capps, Jr. 39°-39° 30′ N.; 106°-106° 30′ W. In *Bull.* 386, U. S. Geol. Surv., 1909. [Colored for formations, contour intervals, 25, 50, and 100 ft.]

MONTANA. Geologic Map and Sections of Lewistown Coal Field, Montana. 1:125,000=1.9 mile to an inch. By W. R. Calvert. In *Bull.* 390, U. S. Geol. Surv., 1909. [Geology in colors, contour interval, 100 ft,, and 4 geological sections showing coal horizons.]

MONTANA. Economic Map of Lewiston Coal Field, Montana. 1 inch=4 miles. In *Bull.* 390, U. S. Geol. Surv., 1909. [Shows coal outcrops, areas of more valuable coal, etc.]

SOUTH DAKOTA. (a) Map of South Dakota showing the Artesian Conditions. 1:1,267,200=20 miles to an inch. [Colored to show formations and depths of Dakota sandstone. Figures in red show depths of artesian wells in feet.] (b) Geologic Map of ———. Same Scale. [16 tints showing formations.] (c) Map of ——— showing the Structure of the Dakota Sandstone. 1 inch=40 miles. [Colored to show different conditions of the sandstone and areas where it is absent. Red contours show altitude of the top of sandstone above sea level.] (d) Map of ——— Artesian Area, showing relative Volumes of Flows from Wells. 1 inch=55 miles. (e) Map showing contour and altitude of Bed-Rock Surface in a Portion of ———. 1 inch=28 miles [Colored.] In "Geology and Underground Waters of South Dakota." By N. H. Darton. *Water Supply Paper* 227, U. S. Geol. Surv., Washington, D. C., 1909.

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Charts of the North Atlantic Ocean, Nov., Dec., 1909.
Pilot Charts of the North Pacific Ocean, Dec., 1909, Jan., 1910.
Pilot Chart of the South Atlantic Ocean, Dec., 1909, Jan. and Feb., 1910.
Pilot Chart of the South Pacific Ocean, Dec., 1909, Jan. and Feb., 1910.

U. S. WEATHER BUREAU MAPS

Meteorological Chart of the North Atlantic Ocean, Jan., Feb., 1910.
Meteorological Chart of the North Pacific Ocean, Jan., Feb., 1910.

UNITED STATES. Chart of the Indiana Coal Field. 1 in.=4 miles. By Edwin F. Lines. With "Supplementary Report on the Coal of Indiana," by George H. Ashley. Department of Geol. and Nat. Resources of Indiana in co-operation with U. S. Geol. Surv., Indianapolis, 1909.

CANADA. Geological Map showing Coal Areas in Alberta, Saskatchewan and Manitoba. No. 1010. 1:2,217,600=35 miles to an inch. 49°-57° N.; 95°-123° W. By D. B. Dowling. With diagrammatic section. In "The Coal Fields of Manitoba, Saskatchewan, Alberta and E. British Columbia," Dep't. of Mines, Geol. Surv. Branch, Ottawa, Can., 1909. [Shows in colors, the different coal formations, and outcrops and the places where analyses have been made.]

CANADAS Geological Survey Map of portions of the Districts of Algoma and Thunder Bay, Ontario. No. 964. To Illustrate Reports of W. J. Wilson and W. H. Collins, 1903-5. 1:506,880=8 miles to an inch. 48° 20′-51° 45′ N.; 83°-89° W. Dep't of Mines, Geol. Surv. Branch, Ottawa, Can., 1909. [5 tints to show formations along the river courses.]

CANADA. Standard Topographical Map. Sheets Belleville and English R., Ontario, and Pembroke, Ontario and Quebec. 1:250,000=3.95 miles to an inch. Dep't. of the Interior, James White, Chief Geographer, Ottawa, 1909. [In a letter to *The Geographical Journal* (Vol. 34, p. 686), replying to criticisms of the sheets of the "Standard Topographical Map" by Major E. H. Hills, Mr. White says that this map is based on the triangulation of the U. S. Lake Survey and on the survey of the north shore of Lake Erie by Dr. Klotz. "For the balance, my maps are based on transit and chain traverses made under my direction, and tied to points that have been accurately determined in latitude and longitude by the staff of the chief astronomer; on the transit and chain surveys for railways, canals, etc." As to the criticism that the sheets contain no contours, hill-shading or heights, in other words, no representation of the form of the ground, Mr. White says that such information was not available at the time of publication, though the elevations of railway stations, principal lakes, etc., are printed on the sheets. As fast as topographic information is available it will be incorporated on new editions of the sheets. In reply to the criticism that the map should not be called "topographical" because it does not show the ground forms, Mr. White says he adopted the name "Standard Topographical Map" and will adhere to it. In notices of these sheets, the *Bulletin* has remarked that the word "Topographical," in the title, is certainly not used in the sense which the geographers of this country apply to it.]

SOUTH AMERICA

BRAZIL. Topographic Map of the State of São Paulo. Folha de S. Bento. 1:100,000=1.5 mile to an inch. (Preliminary Edition.) 22° 30′-23° S.; 2° 30′-3° W. Long. from Rio de Janeiro. Commissão Geographica e Geologica de S. Paulo, São Paulo, 1909. [The contour interval is 25 meters.]

BRAZIL. Mappa do Sul do Brazil. Organisado por Gentil de Assis Moura. 1:2,500,000=39.4 miles to an inch. 15°-32° 30′ S.; 7° E.-19° W. Long. from Rio de Janeiro. European Agents, L. Friederichsen & Co., Hamburg. 25 M. [The compiler of this fine map is connected with the Geographical and Geological Commission of São Paulo which is producing the topographic map of that State. The map includes the States of Rio Grande do Sul, Sta. Catharina, Paraná, São

Paulo, Rio de Janeiro, Espirito Santo, most of Matto Grosso, Goyaz and Minas Geraes and the southern part of Bahia. All available surveys and information have been used, the hydrography and coast lines are sharply defined, the printing is excellent and the very large nomenclature is easily read. The least satisfactory feature is the inadequate expression of the mountains, indicated by brown wash. For general purposes this is probably the most satisfactory map of southern Brazil yet produced.]

DUTCH GUIANA. Kaart van Suriname. 1:1,000,000=15.78 miles to an inch. With "Geologische-en technische Aanteekeningen over de Goudindustrie in Suriname" door E. Middelberg. J. H. de Bussy, Amsterdam, 1908. [Colored for formations. Mining concessions shown.]

PERU. Mapa que comprende las ultimas Exploraciones y Estudios verificados desde 1900 hasta 1906. 1:1,000,000=15.78 miles to an inch. 8°-14° S.; 69°-76° 15′ W. *Bol.* Soc. Geog. de Lima, Año 17, Tomo 21, Trimestre Cuarto, Lima, 1907. [Imposed upon a map in colors of this part of eastern Peru, are the results of the explorations of Col. Portillo and of the surveys for the Central and the projected Eastern railroads, including the first mapping of some of the tributaries of the Rio Madre de Dios.]

PERU. Croquis de los Rios alto Ucayali y bajo Urubamba. 1:500,000=7.5 miles to an inch. 9° 45′ S.; 72° 50′-74° 55′ W. *Bol.* Soc. Geog. de Lima, Año 18, Tomo 23, Trimestre Primero, Lima, 1908. [Based upon the surveys of Col. D. Pedro Portillo. The navigable channels are traced in red according to the studies of Engineer Wertheman and the data of the Portillo expedition of 1900.]

AFRICA

BELGIAN CONGO. Carte commerciale du Congo belge. 1:8,000,000=126.2 miles to an inch. Illustrates "Les Réformes" in *Le Mouve. Géog.*, Vol. 26, No. 44, Cols. 518-26, Brussels, 1909. [Shows in colors the areas that are to be restored to the natives in the years 1910-12, those which will be reserved by the State and the concessions to trading companies which may be subject to revision.]

DAHOMEY. Carte ethnographique et administrative du Dahomey. No scale or map net. *L'Afrique Française*, Vol. 19, No. 11, 1909. [Black and white map reproduced from the ethnographic map recently prepared by the Lieut. Governor of the Colony. Shows the distribution of the tribes.]

DAHOMEY. Carte géologique du Dahomey et dépendances. 1:250,000=3.95 miles to an inch. 6°-14° N.; 2° 45′ W.-1° 45′ E. from Paris. [In "Mission scientifique au Dahomey," by Henry Hubert. Larose, Paris, 1908. 14 colored symbols for formations and 2 geological profiles.]

NORTHEAST RHODESIA. Die Wasserscheide zwischen Zambesi und Kongo. 1:5,000,000=78.9 miles to an inch. 8°-15° 40′ S.; 27°-34° 30′ E. By Albert Bencke. Illustrates paper with same title. *Deutsche Runds. f. Geog. u. Stat.*, Vol. 32, No. 2, Vienna, 1909. [Colored for elevations above sea level.]

WEST AFRICA. Regenverteilung und Pflanzendecke Ober-Guineas und des westlichen Sudans. 1:20,000,000=315.6 miles to an inch. With paper of same title in *Geog. Zeitsch.*, Vol. 15, No. 11, Leipzig, 1909. [A black and white sketch showing distribution of steppe, savanna and forest. Numerals scattered over map show number of dry months (under 30 mm.), in the year.]

ASIA

FRENCH INDO-CHINA. Carte topographique du Service géographique de l'Indo-Chine. 1 inch=1.5 mile. That-kme (Cao-bang.) Hanoi, Tonkin, 1907. [Colors for geological formations.]

FRENCH INDO-CHINA. Carte géologique provisoire du Service des Mines de l'Indo-Chine. 1:100,000=1.5 mile to an inch. That-kme (18.) Hanoi, Tonkin, 1907. [Geologically colored and positions of mineral fields, located, in working or abandoned, and of fosiliferous beds, are indicated.]

FRENCH INDO-CHINA. The following maps appear in *Mémoires* de la Soc. Géol. de France, 4th Series, Vol. 1, Memoirs 3, 4 and 5. Paris, 1907: (a) Carte géologique des feuilles That-Khé, Loung-Tchéou et Pho-Binh-Gia. 1:500,000=7.89 miles to an inch. With *Memoir* 3, "Contribution a l'Étude géologique du Haut-Tonkin," by Capt. G. Zeil; (b) Esquisse d'une Carte géologique du Tonkin d'après les récentes reconnaissances du Service géologique et des officiers du Service géographique de l'Indo-Chine. 1:1,500,000=23.67 miles to an inch. With *Memoir* No. 4, "Note sur la Géologie de l'Indo-Chine," by H. Lantenois. [10 colored symbols and white for formations]; (c) Esquisse géologique du Sud de l'Indo-Chine française. 1:5,000,000=78.9 miles to an inch. Par. René de Lamothe. With *Memoir* 5, "Note sur la Géologie du Cambodge et du Bas-Laos." [7 colored symbols for formation.]

INDIA. Britisch Indien. 2 Maps. (a) Jährliche Niederschlagsmenge. [Six symbols for distribution of rainfall]; (b) Gebiete der häufigsten Dürren-Kalamität. In paper "Über Dürren in Britisch-Indien," *Jahresbericht* der Geog.-Eth. Gesell. in Zürich, 1908-9.

MANCHURIA-HARBIN. La Carte des environs de la ville Kharbin. 1 inch=about 2 miles. Illustrates "Observations météorologiques en Mandchourie," I-r fascicule. L'Observatoire physique Central Nicolas, St. Petersburg, 1909. [A black and white map with contours of elevation, meteorological station, Chinese villages, etc.]

PHILIPPINES. Sketch Map of Northwestern Luzon. No Scale. Illustrates "Distributions of the Non-Christian Tribes of N. W. Luzon" in *Amer. Anthrop.*, Vol. 11, No. 3, 1909. [Shows distribution of Christian and non-Christian settlements.]

AUSTRALASIA AND OCEANIA

TASMANIA. Geological Sketch Map of the North Coast of Tasmania from River Tamar to Circular Head. 1 inch=3 miles. Illustrates paper in *Proc.* Linnean Soc. of N. S. W., Vol. 32, Part 4, Sydney, 1909. [Black and white map with symbols for formations and profile of the coast.]

EUROPE

AUSTRIA. (*a*) Touristen Wanderkarte der Niederösterr. steirischen Alpen u. Voralpen (östlicher Theil); (b) Blatt 6: Reisalpen. Unterberg; (c) 15: Das Gesäuse u. seine Berge; (d) 17: Wachau u. Dunkelsteiner Wald; (e) 22: Waidhofen a. d. Ybbs u. Umgebung. Freytag & Berndt, Vienna, 1909. [Specimens of the convenient, small tourist maps issued by this firm, all on a scale of 1:100,000=1.5 mile to an inch. Clear and artistic maps of mountain regions that are attractive to tourists and easily accessible from Vienna. Descriptive letterpress on the reverse.]

AUSTRIA. G. Freytag's Plan des Verkehrszentrums von Vienna. 1:20,000=1.8 mile to an inch. Freytag & Berndt, Vienna. 40 Heller. [Transportation routes in blue and sketch map showing ward boundaries of the city.]

AUSTRIA. Parts of Vienna: (a) Bezirk Döbling. 1:20,000; (b) Bezirk Fünfhaus. 1:10,000. Freytag & Berndt, Vienna. [Hand maps of Vienna wards for use in the public schools.]

AUSTRIA-HUNGARY AND DEPENDENCIES. Triaskarte der Habsburger Monarchie. 1:1,500,000=23.67 miles to an inch. G. Freytag & Berndt, Vienna. [The purpose is to show by red boundaries (Austria), green (Hungary) and blue (Bosnia and Herzegovina) the geographical relations of the constituent parts of the Hapsburg Monarchy.]

BALKAN STATES. Az északi Balkán Katonai térképe. 1:800,000=12.6 miles to an inch. 40° 15′-45° 35′ N.; 13° 50′-23° 30′ E. Illustrates paper by Jenö Cholnoky in *Bull.* of the Hungarian Geog. Soc., Vol. 37, No. 3. Budapest, 1909. [A good map of the Balkan States as far east as Salonica. A large amount of detail clearly expressed.]

SCOTLAND. Geological Map of Scotland. 1:633,600=10 miles to an inch. New Edition. Reduced chiefly from the Ordnance and Geological Surveys under the direction of Sir Archibald Geikie. Topography by John Bartholomew. With Memoir. John Bartholomew & Co., Edinburgh, 1910. 7s 6d. [The map is folded with the memoir containing 31 pp. of explanatory notes, by Sir Archibald Geikie. The first edition was published in 1892 since which time considerable progress has been made in the geological mapping of the Highlands. Sir Archibald Geikie has revised the notes to represent the present state of our knowledge. On the margins are geological sections through parts of the country.]

SCOTLAND. Pocket Plan of Edinburgh and Suburbs. 1 inch=500 yards. John Bartholomew & Co., Edinburgh, 1909. Paper, 6d; cloth, 1s. [A map in colors on a scale so large that all street names and other nomenclature are easy to read. The indexes to streets, railroad stations, places of interest, etc., on the margins, facilitate reference to all information.]

FRANCE AND SWITZERLAND. La chaîne du Mont Blanc. Nouvelle édition de 1906 en 4 feuilles. IV. Massif du Trient. 1:50,000=0.7 mile to an inch. Beilagen zum Jahrbuch des Schweizer Alpenclub, Band 44, Stämpfli, Bern, 1909. [Ground forms shown by contours with 50 meters interval.]

OCEANS

ATLANTIC OCEAN. Lotungen zwischen Bahia u. den Abrolhos, und Kap Frio, Brasilien. No Scale. 19° 20′-24° S.; 39° 15′-42° 15′ W. Ausgeführt von Kapt. A. Simonsen, 1902-8. [With paper of same title in *Ann. d. Hydrog. u. Mar. Meteorol.*, Vol. 37, No. 12, 1909. A black and white Chart giving soundings for 10 to 40 miles outside those on the British Admiralty Chart. Indicates the nature of the sea floor, the area of greatest depths and the depths formerly given at places resounded.

ATLANTIC OCEAN. Lotungen bei der Insel Fernando Noronha [Brazil]. Scale, 1 inch=1 1/5 nautical mile. Ausgeführt von Kapt. A. Simonsen, 1906-8. *Ann. d. Hydrog. u. Mar. Meteorol.*, Vol. 37, No. 12, 1909.

THE NEW BUILDING OF THE AMERICAN GEOGRAPHICAL SOCIETY

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THE FUTURE HOME OF THE SOCIETY

The fortunate circumstances that have made it possible for the American Geographical Society to secure, for the growing needs of its work, a permanent home far more imposing and commodious than its present house, are described in the *Annual Report* of the Council to the Society. Our frontispiece shows the building now in course of erection at Broadway and 156th Street. In this handsome and dignified structure will center all the future activities of the Society. It will be supplied with every convenience for the conduct of all phases of the Society's work and for the comfort of Fellows, readers, geographical specialists and students who may desire to consult its literary and map collections.

The new building will occupy a part of the old-time Audubon Park. To the west of it are the fine buildings of The Hispanic Society of America, The American Numismatic and Archæological Society and the Spanish Church of Our Lady of Guadalupe, now nearing completion. Just beyond is Riverside Drive and the broad surface of the Hudson, with the wall of the Palisades in the background. Other buildings, devoted to science and art, will probably occupy the remaining sites on this beautiful plateau.

In no over-crowded city could a more ideal spot be found for a center of scientific activity. Occupying one of the higher elevations of Manhattan Island, easily accessible though remote from the great centers of business and traffic, wide Broadway on one side, no crowding of structures on the spacious grounds, the location of our new building is in perfect keeping with the nobility and beauty of the

structure. No wall will touch any side of it. The two façades, shown in the illustration, give a good idea of the whole exterior, all the faces of the building being similar in design.

The building will have a frontage of 65 feet on Broadway and 125 feet on 156th Street; the main entrance will be on the south side, reached through a Broadway gate and a walk traversing a wide court. Built entirely of Indiana limestone, the structure will be in the style of the Italian Renaissance, conforming in architectural design to the other buildings on the grounds. It will have four stories and a basement, the latter extending under the entire building and affording large space for the storage of publications, map plates and supplies, the engine room, heating plant, workshop, rooms for the caretaker, etc.

A most interesting feature is the stack rooms, in the west part of the building, where the book collections will be kept. There are to be six stack floors, each 57 by 33 feet, and every one easily accessible from all the others and from each of the four floors of the main building. These six floors will have a storage capacity about five times as large as that of our present library, to say nothing of the book storage facilities reserved in the basement. Provisions are thus made for the accumulations of generations to come.

The main entrance is through an oval vestibule leading to a wide hall, opening out of which are the business office, a spacious room for meetings of the Council of the Society and two large rooms extending along the 156th Street front. These rooms, when desirable, may be thrown into one and used for a lecture hall. They will seat about 400 persons and will well serve the purposes of scientific meetings and other occasions when the attendance is not expected to be large. Adjoining the office, is a room for the mailing department and the storage of the Society's *Bulletin*. An electric elevator will run between the basement and the top floor.

The offices of the editorial and library departments are on the second floor. On the south side of the building overlooking the court, are the rooms of the librarian and his assistants and a reception room to which visitors will be directed. Across the hall and extending along the 156th Street front from Broadway to the stack rooms, are two editorial rooms and a spacious magazine and reading room. The geographical periodicals of every land will be kept in the reading room where visitors will find every convenience for consulting the current literature of the earth studies. Specialists and others who come to the Society for study and research, will find

accommodations in a number of study rooms on the second and third floors where the books and map material desired may be assembled and each may pursue his work in quiet.

The third floor will be entirely given to the map department and study rooms. Here are the offices of the map curator and his assistants. About two-thirds of the entire space will be devoted to two map rooms where the rapidly growing cartographic collections will be stored in a manner that will safeguard them, as much as possible, against dust and deterioration, while each item will be easily accessible.

The chief feature of the fourth floor will be the large map-drafting room, with abundance of overhead light for craftsmen engaged in a branch of the graphic arts which, in its finer phases, is trying to the eyes. Here, also is the fan-room, the culminating feature of the system of ventilation which is to give perfect circulation of air throughout the building. It is needless here to speak in any detail, of the numerous conveniences on every floor, such as book-lifts, filing compartments for manuscripts, enclosed pigeonholes, hot and cold water from basement to roof, etc., which will greatly facilitate the duties of the working staff. A telephone system will connect all the departments.

The frontispiece shows the name of the Society on the Broadway façade of the building. The names of about thirty of the most illustrious explorers, geographers and cartographers of past centuries will be similarly placed on the other façades. No inflammable material will enter into the construction of the building, which is to be as nearly fireproof as it is possible to make it.

Many geographers throughout the country have already expressed interest in this new and great addition to the facilities of the Society; and our Fellows cannot fail to share the feeling of the Council that, when this noble building is completed, "it will be an ornament to the city and a credit to the Society, its President and all concerned."

A GEOGRAPHICAL DESCRIPTION OF SOUTHAMPTON ISLAND AND NOTES UPON THE ESKIMO

BY

GEORGE COMER*

The Island of Southampton, lying, as it does, in the great ice belt at the extreme northerly end of Hudson Bay, has no especial commercial value and is practically inaccessible during the greater part of the year. The writer, nevertheless, has prepared the accompanying map and written the following description of the island and its people, both of which may be of practical assistance to subsequent explorers and of scientific interest to those who are studying the many problems of arctic life.

The Island of Southampton is about 175 miles from north to south and approximately the same from east to west. There are but few places on the west and south shores where it is safe for a vessel to "stand in" nearer than five miles, and to the south of Cape Kendall even ten miles is dangerous. A hitherto unknown reef, three miles in length, lies about fifteen miles north of Cape Kendall in Lat. 64° 17′. It is especially dangerous, since it can be seen only at low tide, although deep water is found from two to three miles on either side. A strong current (which I have estimated at about six miles a day) sweeps by Cape Kendall and strikes across this reef to the north of Whale Point, thence south past Cape Fullerton.

On older maps, an island (known as Tom Island) is indicated to the south of Cape Kendall. This does not exist. The error may be explained by the fact that at this point the waters are shallow, and the ice, in forming, takes up large quantities of rock and dirt, which gives the drifting mass the appearance of land. The existence of Walrus Island (Lat. 63° 17′), in Fisher Strait, has been authenticated; but "Bell Island" is not separated from the

* Captain George Comer has had an experience of thirty-five years as a whaler in Cumberland Gulf and Hudson Bay, and has spent ten winters on Southampton Island and the contiguous shores of the mainland. Several years ago The American Museum of Natural History, recognizing his reliability as an observer and his zeal as a collector, encouraged him to study the country near the mouth of Hudson Bay, to acquaint himself with the primitive people of Southampton Island and the neighboring shores, and to make collections for the Museum illustrating the zoölogy, geology and ethnology of the region. During his voyage of 1907–1909, Captain Comer made a survey of Southampton Island, and his friends at the Museum and at the American Geographical Society have urged him to prepare the paper published herewith.—Editor.

main portion of Southampton Island, although a deep indentation and intervening low land give it an insular appearance. A point of land projecting from the north shore of "Bell Island" has also been erroneously termed "Gore Island."

Perhaps the most important feature of this map is the charting of the south shore and the locating of a very good harbor at the head of South Bay, which, because of the peculiar red "coral" that was frequently brought up by the lead in taking soundings, I have named "Coral Harbor." In heading up this bay it is well to keep to the west shore, but when nearing the north shore, bear to the east between two islands and follow a course E. S. E., passing south of Guard Rock which lies at the south end of a reef making out from the north shore (Seal Point). This rock lies in water eight or nine fathoms deep and is covered at high tide. I judged the tide to rise about eight feet at this point. After passing Guard Rock, one may proceed in a northeasterly direction, finally anchoring in six or seven fathoms of water. Several islands not shown in the map lie along the north shore of this harbor, which is about seven miles in width.

As one approaches Southampton Island from the west, a distinctly stratified limestone is discernible. A long, low mountain range, in altitude about 500 to 1,000 feet, and broken in two places, stretches across the northeast coast bordering Fox Channel, and presents a barrier to the chilling blasts from the north. From the granite foothills an irregular limestone plain extends towards the west and southwest. Near Manico Point and Cape Kendall is the highest land on the west shore, the hills rising to a height of 150 to 200 feet. Two hills, of a peculiar shed-like appearance, are seen, one at the entrance to South Bay, the other near that of Coral Harbor.

A thorough survey of the southwest shore resulted in the making of certain very radical changes in the coast line, as may be seen by comparison with previous maps, and I hereby desire to name the newly discovered point of land (which lies between Manico Point and the above-mentioned hill at the entrance to South Bay) Cape Low, in honor of Mr. A. P. Low, Department Minister of Mines, Ottawa, Canada.

During the summer the island is entirely free from snow, with the exception of a few drifts on the mountain sides. From the middle of July to the middle of August the air is filled with innumerable swarms of mosquitoes, which make life unbearable to

other than the natives. The Eskimos, however, minimize the annoyance by allowing the hair to grow long and switching the face by keeping the head in constant motion. During the warm weather the bear and caribou seek the cooler places among the mountains. The low lands produce an abundance of grass, waving in the winds like the wheat-fields of the temperate zone; in the higher altitudes, of course, there is less vegetation—sedges border the ponds.

From Native Point north to the foothills, a distance of 15 to 20 miles, the land is very low and the bays are shallow. Water-fowl frequent these shallow waters, and in the summer season are taken by the Eskimos, who use snares made of whalebone. Salmon trout are also found in certain of the ponds in great abundance. Remaining in the ponds and streams until the summer freshets take place, the trout migrate in July to the sea, where shrimp are plentiful. They return in six or eight weeks in fine condition. The spawning season occurs late in September.

The Southampton caribou differ in size somewhat from those of the mainland, but so far as the writer knows, a complete specimen has never reached the hands of the scientist, and the species, therefore, remains to be described. Wolves are not numerous, and, of late, the same is true of the arctic fox.

As the island had not been inhabited since 1903, in the summer of 1908 I left the greater number of my natives (Eskimos from Repulse Bay) on Southampton Island, hoping that they might procure a quantity of fox-skins, but on my return in 1909, I found, to my surprise, that they had taken but few. The scarcity of these animals is accounted for by the fact that ordinarily they gather around the native settlements and feed upon the refuse of the chase. The small temporary encampments of 1908-1909 probably were not sufficiently alluring to attract numbers of these predatory animals.

Although, as above stated, Southampton Island is apparently of little importance from a commercial standpoint, it has great interest for the ethnologist.

When, in 1896, I first met the natives of the island, they numbered about seventy, and as our boat approached the island near Manico Point, the men and children followed along the shore until we found a landing place. They made short, high jumps and called out in imitation of the great loon, "Whar whee! Whar whee!" an expression which they always used to denote appreciation and pleasure. The Eskimos from the mainland on board my vessel

assured me that the presence of the children was an indication of good will, and as we were particularly anxious to make certain inquiries regarding the whaling prospects, we decided to go ashore. The island Eskimos (known as the Saglernmiut—miut meaning tribe) led us to their houses—seven in number and located near the coast—the first of the kind that I had ever seen, since the Eskimos of the mainland live in snow houses and skin tents, very different in structure from the dwellings of the Southampton natives. It is true that on the mainland there are ruins of the same type as those found on the island, which show great age—indeed, the natives of the mainland have no knowledge of the remote times in which they were occupied.

The island huts we found to be circular in shape, skilfully constructed of limestone and built partly under ground. The roofs consisted of a framework made of the long jaw-bones of the whale, the inner ends resting on a king post; upon these bones were flat limestone blocks, and over these a layer of sod. Light was let in through an opening above the entrance, over which was drawn a piece of translucent parchment from the intestine of the seal. The entrance was partly under ground and very low, and usually served also as a drain. Lockers and chests for the storing of materials were numerous, being neatly made of limestone. Some were let into the sides of the houses and others were built underneath the sleeping places. In the summer the sod and stone houses were abandoned and skin tents temporarily erected in the neighborhood.

The Eskimos of my party (which, as stated above, were from Repulse Bay, not more than a hundred miles distant), found it difficult to make themselves understood, for while the dialect is similar, the intonation is quite different. The women, however, grasped our meaning much more quickly than the men. One young man pointed with pride to his house and said that it was his now, as his father was dead. The significance of his pride will be the better appreciated when it is known that any person who is sick unto death, if possible, is moved immediately into the open to die, since the occurrence of death in any house causes its abandonment. The young man felt that he should be commended for so arranging the death of his father as to leave the family estate unencumbered.

There are several traditions current among the natives as to how Southampton came to be inhabited, and I recite the following, as it seems to give a reasonable explanation of the original settlement.

In the long ago, two young men went hunting together, and as

one never returned, it was believed that he had been slain by his companion in order that the companion might marry the widow. But this woman, upon the advice of her friends, killed the slayer of her husband, and fearing that his relatives might then seek revenge on herself and family, she harnessed the dogs and hurried away in the night over the ice. When daylight came the refugees found that they were indeed pursued, and the mother, who had great power as an "Anticoak," caused the ice to crack and open between them and their pursuers, thereby saving them from their enemies. They kept steadily onward in their course, finally reaching Southampton Island, the land of their adoption.

An incident of recent occurrence would tend to show the origin of this story: in the spring of 1904 a party of sixteen natives were sealing on the ice in Repulse Bay, when the ice broke up and carried them to Southampton Island. A year later I happened to land at Duke of York Bay, and hearing of their wish to return to their former home, I brought them back to the mainland.

That the first inhabitants of the island came from Gore Bay and Lyon Inlet, across Frozen Straits, is very probable, although their dress would indicate that they were of the eastern Innuit.

A story is told by the old people of the Aivilik tribe that long ago there lived south of Wager Inlet a tribe known as the Nuvukmiut. (This tribe was exterminated later by the Aivilik, under the leadership of Oud Lin Uke, a famous warrior.) During the winter, when the ice stretched firmly across from the island to the mainland, a party of five Southampton natives walked over to the Nuvuk settlement, where they were met by an equal number of men from that tribe, each carrying a spear. They at once engaged in friendly combat, during which one of the Southampton men was wounded. He called to his father, who reassured him, saying that this encounter would establish amicable relations between the two tribes.

The Aivilik further relate that during this visit one of the Saglernmiut saw a "six six," or ground squirrel, sitting on a rock, which began to chatter as he came near and then ran away and hid. Having never seen any of these animals, the man thought that it was one of the Guardian Spirits of the Nuvuck, until it was explained to him that the species was common in that country. Later the Saglern returned to their own island, and so far as is known, this was their first and only contact with the mainland Innuit.

The Southampton natives related to the Eskimos of my party

that formerly they had passed back and forth northeasterly between what is known as "Bell Island" and Kings Cape, the natives of the latter place being called the "Secoceilyermiut" (*i. e.,* ice goes away, or the shores where the ice is kept moving by the currents). It is also said that the last man to go over to Kings Cape never returned, and it is thought that he was killed.

The little knowledge that we have of the Southampton natives may be due to the fact that until the discovery of Coral Harbor no safe place of anchorage was known. On the south and west shores of the island a boat which lands at high tide has to remain until the tide rises again. One of the best places to approach is just south of Coral Harbor at Native Point, which portion of the island also furnishes one of the best camping places. Here a boat can land on either side of the Point, but the south side is preferable, owing to a lagoon which occurs there in which a small boat may remain in perfect safety. The houses on this point were the last to be occupied by the Saglernmiut.

That they were a fearless people is evidenced by the numerous head-bones of the whale which are to be found in the construction of their houses. For an Eskimo in his frail kayak to attempt to capture a whale with the primitive implements which they manufactured meant great courage, although it is probable that, in general, only small whales were taken. In the summer the natives ran out on the ice and harpooned the whales without using a boat, which, of course, involved but little danger.

One of the natives whom I knew quite well was called "Cumercowyer" (*i. e.,* could see the whale under water). When he died he requested that his body should be placed on the ice so that later it would drop into the sea. At the same time he charged his people that when they went off on the ice or in their kayaks for whales, they must throw a piece of meat into the water and call on his spirit to aid them. He promised that he would hear their call and come to their assistance. Being a friend of "Cumercowyer" I also was supposed to throw over a piece of meat and invoke his spirit to help us in catching our whales.

In hunting caribou, the natives crouch down behind a ridge of stone which they prepare, and there they lie in wait, having first placed a bird-skin covering over the head.

As we had been quite successful in taking whales around the island, a station was erected in 1897 between Manico Point and Cape Low, where one hundred and twenty-five natives from other parts

of the bay were landed. All were well supplied with guns, and also with good boats and sleds, with which the Saglern, who had hunted over the ground for centuries, could not compete. The station proved a failure, and when it was removed to Repulse Bay in 1903, only one woman and four children went with it, the sole survivors of a once numerous people. They were adopted by the Iwilic of Repulse Bay, and when, in 1908, I left a colony of about seventy Aiviliks on Southampton Island at a point north of Cape Kendall, among them were two surviving children of the Saglernmiut—too young, however, to remember the traditions and customs of their people.

Before closing this article, I feel it my duty to call the attention of all governments that are interested in the whaling industry of Hudson Bay and Straits to the need of some uniform legislation which will restrict the indiscriminate slaughter of these animals. I am speaking as one who has had years of experience, and I do not hesitate to predict the early extermination of the whales in these enclosed waters unless some restrictive measure is adopted. During the summer months, whales, seals and the abundance of terrestrial animal life add so materially to the interest of the country, that it would be a public calamity for the zeal of those commercially interested to destroy these features of its attractiveness.

TRADE ROUTES IN THE ECONOMIC GEOGRAPHY OF BOLIVIA*

(*Continued*)

BY

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Argentina-Bolivia.

The Antofagasta railway, ever since its completion in 1892, has been the sole means of rail transportation to southern and central Bolivia. This position it will soon lose as work on the new line is now completed to the Argentine frontier at La Quiaca and a recent understanding between Bolivia and the Argentine Republic provides

* See *Bulletin*, January, 1910, p. 22.

for its extension to Uyuni by the latter country at an early date. The line follows in the general direction of the old mule track into Bolivia, one of the most famous of the early South American roads. The mule track runs for much of the distance along the water-courses, naturally graded and firm roads in the dry season, but impassable when the streams are in flood. Over this route came a

FIG. 10. LANDING FREIGHT AT ANTOFAGASTA.

Cargoes are unloaded from the lighters by cranes or carried on the backs of workmen.

portion of the goods supplied to Argentina, via Panama, in the days when that port enjoyed a trading monopoly of all the goods sent to Spanish America. Later, when importations came via Buenos Aires, caravans began regular journeys into Bolivia bearing merchandise of cloth chiefly, besides important quantities of tea, spices, jewelry and the costlier varieties of hardware. For these,

were exchanged the silver, blankets, dried and hence light-weight potatoes, and the coca, of the mountain Indians. It is interesting to note that a large part of the exchange is by barter even to this day, though purchases were made outright, from the first, owing to the lack of plateau products of sufficient amount to balance the Argentine trade, and the large quantities of tin and silver the plateau has always produced, which in both its stamped and unstamped condition has served as currency among the traders.

Great quantities of goods go over this trail to-day and the quantity is steadily increasing as the progressive northerly extension of the road reduces, by corresponding amounts, the high freight charges for mule transportation. The goods are now shipped cheaply by rail to the Argentine border and thence go by freight coach or pack mule 175 miles to the railroad at Uyuni. They are then available at any of the stations as far as Oruro and La Paz. At Challapata the goods may be shipped by mule cart to Sucre and at Oruro by freight coach or caravan to Cochabamba. Italian traders among others make this journey with cloth goods ranging in quality from cheap woolens to expensive silks. Orders are not taken to be filled later, but the traveling salesman brings his entire stock with him and when he is sold out returns for another consignment. The annual fair at Huari, 60-70 miles south of Oruro, also witnesses a great movement of goods over the old road. For a time, trade over this route fell off, notably on account of cheaper shipping facilities over the Antofagasta route* but the road from the south has been extended so far that the current of trade from this direction is now regaining its old-time force.

The distinctive quality of the completed road will be its connection with an Atlantic port. Its advantage over the Antofagasta route for both European and American shipments of the tin, copper and silver of Bolivia will be considerable and will continue to be so until the completion of the Panama Canal, which it will undoubtedly antedate by at least several years. What this advantage will be may be appreciated by a comparison of distances. The significance of these is emphatic not only for Bolivia, but for well-nigh every section of South America because the energy of the country is still almost wholly devoted to the extractive industries and hence products are disposed of in the Atlantic countries of the northern hemisphere, and manufactured wares are desired from the same source. From Uyuni to the coast, via the Antofagasta line, is 300

* Hoek, H., Exploration in Bolivia, *The Geog. Journ.*, vol. 25, 1905.

miles and to Buenos Aires, via Jujuy and Tupiza, is 1,100 miles. But at these ports, the ore is 11,000 miles and 7,000 miles respectively from Liverpool. The Panama Canal would change these relations and give the Antofagasta line the advantage of one-third the number of miles of land haul and an ocean voyage of but 4,500 miles to reach New York, though in comparison with shipments to Liverpool this advantage is lessened to approximately 1,000 miles.

Besides these advantages are those arising from the mineral wealth along much of the mountainous section of the line and the abundant agricultural products of Jujuy and the irrigated valleys adjacent which have awaited their best development for years until the completion of this outlet to the seaboard. Branch lines are being taken up slowly to the rich borax and nitrate deposits of the arid northwestern section of Argentina (those to La Rioja and Catamarca are already completed) and the deposits of copper and tin that occur there. (Fig. 12.)

Plateau-Plains.

The various projects of the railroad development of eastern and central Bolivia are so intimately associated with each other that a general description of the circumstances leading up to the present activity seems desirable.

In 1904 there was signed at Petropolis, Brazil, a treaty* between Brazil and Bolivia for the settlement of a boundary dispute involving the territory known as "Acre." The land in question came into dispute through the influx of large numbers of Brazilian rubber gatherers and exploiters who found the then rich rubber territory in the valleys of the Purus and Aquiri, tributaries of the Madeira, but little developed by Bolivians. After a complex series of events, one of which was the formation of a new but short-lived "Republic of Acre," the difficulty was overcome by the treaty of Petropolis, by the terms of which Bolivia quit-claimed its right to 73,720 square miles of the disputed territory for £2,000,000. Bolivia acquired a valuable triangular-shaped district of 886 square miles between the Abuna and Madeira rivers and four other small pieces of land aggregating 335 square miles on the western bank of the Paraguay. In accepting the £2,000,000 for her lost territory Bolivia recorded her

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* Daily Consular and Trade *Report*, No. 2987, Oct. 2, 1907. The Acre Territory and the Caoutchouc Region of South-western Amazonia, by Col. G. E. Church. *Geog. Journ.*, vol. 23, 1904, pp. 596–613.

New Boundary between Brazil and Bolivia. *Bull.* Am. Geog. Soc., vol. 36. 1904, pp. 215–216.

Survey Work on the Frontier between Bolivia and Brazil, Maj. P. H. Fawcett, *Geog. Journ.*, vol. 33, No. 2, Feb. 1909, pp. 181–185.

intention of applying the money principally to the construction of railways and other works tending to better communications and to develop commerce between the two countries. Other provisions of the treaty are of almost equal importance as the basis of the present movement of goods and as improvements designed to facilitate commerce. There is to be perfect liberty of land transportation and river navigation for both nations. Brazil agreed to build, within a period of 4 years, the Madeira and Mamoré railway from San Antonio, at the lower end of the series of falls on the Madeira, to Guaya-Mirim, on the Mamoré (one of the two main affluents of the Madeira, the other being the Beni) with a branch line to Villa Bella in Bolivia; and both countries are to be admitted to equal privileges and tariffs with respect to it. While the terms of the treaty have not been carried out to completion by Brazil in the time designated, a beginning of the line was made by the granting of a concession in 1906 to an American syndicate to construct port works at Para (Belem) at the mouth of the Amazon river. It is true that before this, i. e., soon after the signing of the treaty of Petropolis, the Brazilian Government granted a concession for the construction of the Madeira-Mamoré railway. The concession was granted to a Brazilian as against an American syndicate and French capital was secured to work it as a Brazilian concern. Nothing came of these activities, however, and the real beginning of the line dates from the purchase by an American syndicate of the Brazilian concession and the acquisition of the Para concession as well. It is understood that Mae, Jekyll & Co. are the promoters of the enterprise and that actual work is progressing rapidly. A party of thirty men under charge of H. C. Miller, at one time chief assistant in a Nicaraguan Canal survey, are actually engaged in the preliminary work. Warehouses, workmen's cottages, and even a cold-storage plant have been constructed; and about 40 miles of the new line are now complete.*

Quite apart from the interest that attaches to the commercial importance of the line is the widespread popular interest growing out of the construction of a railway in the depths of the Amazon forest over the same ill-fated route that marked the failure of the Collin's scheme of Philadelphia, in the late '70's, and that resulted in one of the most tragic episodes of modern industrial history.§ Only

* *Bull.* Internat. Bureau Am. Republics, Jan., 1910.

§ Recollections of an Ill-fated Expedition to the Headwaters of the Madeira River in Brazil. N. B. Craig. 1907, pp. 479, and map.

a few kilometers of rails were actually laid and no trade whatever was or is served by the line as finally abandoned. The falls of the Madeira remained the same stern obstacle to trade as formerly and Bolivia's dream of a highway to the Atlantic was rudely shattered, first by the failures in the construction work, and finally by the perfidy of the financial agents of Bolivia at London.

The two fundamental considerations in the estimate of the value of the Madeira route and the importance of the railway are, first,

FIG. II.

Native mining works at Huynuni, Bolivia. At this locality very modern reducing works are also located, the ore being shipped by mule cart thirty miles to the railway. Heavy machinery is brought in, in the same manner.

the character of the route as a highway, i. e., the physical layout of the region; and, second, the nature and amount of the products to be secured. The map, fig 4, represents the territory involved in this discussion and at once emphatically indicates the most important fact in the physical geography of the region, the convergence of all the river ways upon the Madeira above the falls. From Cachuela Esperanza on the Beni and from the falls of Guaya-Mirim

on the Mamoré, 500-700 feet above sea level, there begins a line of rapids, varying in height and number with the height of the water, but there are never less than eleven, and they cover a stretch of river 229 miles long. They thus constitute a trade obstruction in the very throat of tropical Bolivia. The real significance of the obstruction is better appreciated by realizing that the falls occur from 300-500 miles from the base of the Andes, as the crow flies, or probably over 2½ times that distance by river course. They are not, therefore, on the edge of the tropical plains, but well within them. This fact alone would make them a serious impediment to traffic even if there were but a single main stream with few tributaries. But with these great affluents converging their waters and their commerce to the Madeira, the obstruction becomes a nuisance, an actual barrier to the commerce of all eastern Bolivia from its northern boundary to Sucre and from the altiplano to the eastern limits of the Republic.

The river freights are transported about the falls on land by means of rafts, canoes and batelons.* Goods are occasionally stored at San Antonio for months at a time awaiting transportation upstream, the number of canoe-men being always limited and often unobtainable. Boats that attempt to run the rapids at high water are sometimes successful, but the safer, though more tedious and costly way, is to unload the cargo and laboriously drag it around the principal falls. These are eleven in number. At six of the eleven the launches have nearly always to be passed overland, a total distance of 13,889 feet. There are five rapids where the launches must be unloaded and towed with ropes, a total distance of 12,628 feet. These figures total five miles of distance where the freight must be unloaded and carried overland. All the remaining rapids are difficult of transit where loaded craft shoot with the current or are dragged upstream near the river margin.†

What this drawing away of the Indian from agricultural or other productive labor means in a region where labor has always been scarce and expensive and what this means under the severe tropical conditions prevailing there may easily be inferred. In some cases the batelons are skidded around the falls over a corduroy of round, easily-rolled young timber. Col. Church states that the cost of transportating goods past the falls of the Madeira is no less than £85 per ton. Were chocolate and rubber less precious commodities

* Several ton barges, strongly constructed.

† The Route to Bolivia via the River Amazon. A Report to the Governments of Bolivia and Brazil; G. E. Church, London, 1877, p. 183, *et seq.*

CORRECTED MAP
OF
SOUTHAMPTON ISLAND
FROM OBSERVATIONS AND SKETCHES
BY
CAPTAIN GEORGE COMER
MASTER OF THE SCHOONER A.T. GIFFORD
STATUTE MILES
FOX CHANNEL
SOUTHAMPTON ISLAND
REPULSE BAY
Gibson Cove
Ship Harbor Islands
BLUE LANDS
Safety Cove
LYON INLET
Winter I.
CAPE HOPE
Halls Islands
S.E.CAPE
BEACH PT.
GORE BAY
C. MARTINEAU
CAPE FRIGID
FROZEN STR.
Boat Channel
White Isl.
Vansittart Island
CAPE DEAS THOMSON
Nias I.
Black Rocks
CAPE WELSFORD
Beach
Salmon Pond
DUKE OF YORK BAY
CAPE BYLOT
CAPE COMFORT
CAPE MONTAGUE
WAGER INLET
Very strong Tide
CAPE DOBBS
STRAIT
SIR THOMAS ROE'S WELCOME
Shingly Beach
Salmon Pond
LIMESTONE
Granite
Salmon Stream
Salmon Pond
Mt. Zion
NE ULTRA
CAPE FISHER
Large Stream
Yellow Bluff
Snow usually seen on This Mount
WHALE PT.
(WHALEBONE PT.)
REEF
Foot Hills
Salmon Pond
Peculiar Hill (shed like)
Coral Harbor
Guard Rk.
MC MURDO PT.
SMALL LIMESTONE
"Gore I."
TERROR PT.
LIMESTONE
Bear I.
Shallow Bay
SOUTH BAY
NATIVE PT.
Mt. Minto
SEAHORSE PT.
"BELL ISLAND"
Current about 6 miles a day
Rough Bottom
CAPE KENDALL
Good Water
LEYSON PT.
BAY OF GOD'S MERCY
MANICO PT.
Walrus I.
EVANS INLET
Peculiar Hill (shed like)
C. PREFONTAIN
C. PEMBROKE
Low and Shingly
CAPE LOW
Vessel Track
FISHER STRAIT
COATS I.
Very low and dangerous
DRAWN BY A. BRIESEMEISTER

or less indispensable luxuries to the people of the temperate zone they would never be able to bear the tax the falls levy upon these already expensively gathered products. As the trade of Caupolican Bolivia, the Yungus, and the Mojos, totals several million pounds sterling a year the tribute levied by the rocky obstructions and reefs is little short of enormous.

As for the products of the region which go down river and will feed the Madeira-Mamoré railway, they are to-day chiefly rubber, with some chocolate and hides, but the ultimate resources of the region, the limits of production, no one can estimate. Even to-day, difficult and expensive as transportation is, either up or down river, cattle grazing is an important industry on the grassy plains between

FIG. 12.

Workmen grading the road bed between Oruro and La Paz (1907). Wheelbarrows are provided, but the Indians prefer to use their blankets. Each Indian must work fifteen days on the road at thirty cents a day.

Villa Bella, Reyes and Trinidad, and even as far south as Santa Cruz in Bolivia; while in Brazil and Paraguay the cattle-raising district extends still further south. The grassy plains between the lower Beni and Mamoré are the northern limit of the grass lands in Bolivia and are now scarcely touched by the limited stock of the region. The herds supply meat for the residents of the districts, hides for shipment and draught animals for the ox carts that, slow, uncertain and expensive, are notwithstanding, almost the sole means of transport away from the rivers. At present the downstream trade in hides is very slight, the bulk of the cargoes going upstream to La Paz and the Pacific coast. Cheap downstream transportation

would mean a vast development of the cattle industry which requires but few laborers, a primary desideratum in this notoriously laborless land where the rubber industry itself would languish were it not for the system of enforced labor or peonage practised here almost universally. Not only would the hides find a profitable market in the leather establishments of the temperate zone, but the meat as well would be a source of great profit. Para and Manaos, particularly the latter city, which is only 600-700 miles from Villa Bella, could be supplied from the Bolivian llanos with fresh meat by transport boats of suitable pattern instead of being largely supplied with tinned meat from the United States and Europe, as at present. What a railway upstream to La Paz or Cochabamba would mean to the cattle industry may be gleaned from the fact that at Reyes, in north central Bolivia, a steer out in the field is said to cost 50 cents gold, tied to a stake $1.25, and driven to La Paz and sold for meat $35.00, if he survives the arduous journey of many score miles over a difficult trail.

Notable quantities of rubber and chocolate are likewise shipped upstream over the same routes via La Paz, Cochabamba and Oruro to the Pacific coast. These are return cargoes carried back more for the saving they effect on the merchandise that constitutes the downstream freight than for the freight earnings that the expenses of the uphill movement of goods often more than consumes. For it is a curious fact that Trinidad, Villa Bella, Santa Rosa and many other towns of this region acquire their supplies of merchandise largely from the west. Canned goods, cloth, iron and steel utensils, salt, tobacco, flour, potatoes, liquors, shoes, etc., are brought, some from the United States, via Panama, some from England, Germany and France, via the Straits of Magellan and taken over the Antofagasta or Mollendo railways to Oruro or La Paz. If to La Paz, they must be taken a two-days' coach journey to Sorata and so by pack animals to the Beni or the Mapiri; if to Oruro, by freight coach to Cochabamba and by caravan a journey of one to two weeks (depending on the state of the roads), to Santa Rosa at the head of canoe navigation. From this point on transport is easy. Indeed, the only seriously difficult part of this route from the shops of England, say, to the stores of Trinidad on the Mamoré is the one to two weeks caravan section from Cochabamba to Santa Rosa. The wet season may make the streams impassable between Cochabamba and Oruro, or the trail a bog-mire between the former city and Santa Rosa, but these are only short-lived difficulties. Several

Photo by Brooks.

FIG 13.

The true mountain character of the lofty ranges that form the core of the great Bolivia Andes is indicated here. It represents a portion of the Nevados de Araca at about 17,500 feet, or the level of the snowline.

Cochabamba merchants make this downstream trade a special business and are able to supply their goods more cheaply and more certainly than those merchants who import via the Amazon and the expensive falls of the Madeira. There is thus a zone in the Madeira valley in which costs, via the Amazon route and the falls of the Madeira, and costs, via the Magellan and Pacific route, approximately balance. The balancing point appears to lie within the falls zone.

This fact alone expresses well the severe tax the falls are upon transport as compared with expenses elsewhere in the journey. Where they not so high, the pivotal point would, of course, depend on the relations of the more obvious factors of long ocean voyages, launch service and railway, and caravan transport. Very little plateau merchandise finds its way to San Antonio and likewise only small amounts of San Antonio goods are ever carried to Trinidad and Villa Bella. With the falls railway completed this pivotal point will be moved well up toward the head of launch navigation on the affluents of the Madeira, if, indeed, not to the very base of the Andes. It may even be that, with the completion of the Madeira railway and of the cart roads now building northeast of Cochabamba and north of La Paz, many of the villages on the eastern Andes may be supplied by up-river rather than over-mountain routes. (Fig. 13.)

Most of the rubber, chocolate and hides now shipped upstream and finally via Oruro and La Paz to the Pacific coast is curiously transported as to direction. The chief cause for these trans-Andine shipments is not a cheaper route, for it is, of course, a much more expensive route than the downstream one to Para, but merely that the canoes, and batelons, returning with difficulty against the current, from Trinidad, after disposing of their cargoes there, can more profitably bring light return cargoes than none at all and similarly the mules of the eastward moving caravans are hired for the round trip, not for the outward journey alone, and some return cargo is here likewise demanded. Merchants in Cochabamba, Oruro and La Paz are often paid for their imported merchandise in this way with the currency of the plains: rubber, chocolate and hides, from the upper Madeira.

It is doubtful even to the most optimistic student of Bolivia's resources whether the dream of numerous railroads penetrating to the eastern foot of the Andes (Fig. 11) will ever be an accomplished fact, except at a few highly strategic places. The traffic will scarcely bear more than two such lines in all the great stretch of

country between the Beni and the easternmost counterfort, or spur, of the Andes at Santa Cruz de la Sierra. The two principal mule trails to tropical Bolivia are from La Paz to the Beni and from Cochabamba to the Chaparé and one or the other of these will undoubtedly be the locus of ultimate railroad activity. Such railways, by penetrating to the head of navigation on either of these two streams, could at once command by auxiliary launch service the traffic of the whole of a single great tributary. From the standpoint of such a railway the gravest defect of the physical geography of the tributaries of the Madeira is the existence of falls in both the Beni and the Mamoré, unfortunately just about their junction to form the Madeira. Were these eliminated, both streams would by launch service contribute their products to a single railway built to either stream. It is certain that the defect will delay railroad building many decades, if not centuries. The most reasonable solution that suggests itself is that the Beni territory will ultimately be served by a trans-Andine railway while the next southerly road will be to Santa Cruz and the Paraguay. From such trunk lines branches could then be extended along the eastern foot of the mountains and would likewise put the Mamoré basin into touch with rapid and cheap means of communication.

No one can fail to see the stimulating effect such a railway would have upon the eastern Andes. Few now unoccupied districts in South America would seem destined to an ultimate development greater than that of the eastern Andine valleys and the plains tracts adjacent. There one may find elevations and temperatures to suit every purpose and every constitution. No more delightful spots can be found in all tropical South America than here: suitable and relatively constant thermic conditions, sufficient rainfall, yet not a burdensome excess, timber for construction, rich products of field and garden and mine. The resources of the region are scarcely touched to-day. The eye roams over hundreds of square miles of delightful country with only the most insignificant scattering of agricultural folk. The necessities of life, the bananas, oranges, potatoes, meats, etc., are gained almost without effort; the luxuries, such as good tobacco, utensils of house and garden, and fine clothes, require but the most ordinary and limited attention to the cultivation of the coca tree and the curing of its leaf. Except for transport, partly on the backs of human carriers, of the coca leaf—the currency of the region—life is easy, tranquil, bountiful. The equalization of eastern tropical valley and plains products on the one hand and the plateau products on the other is now but feebly ac-

complished by a system of weekly fairs, of which that at Cliza, 30 miles southeast of Cochabamba, is undoubtedly the largest and most interesting. Every Sunday thousands of vendors from an area 50 to 70 miles in radius gather for barter and sale. Fruits and grains and cattle of the fertile Misque valleys and even sugar and rice from Santa Cruz are here gathered for exchange with the potatoes and barley and silver of the plateau Indians. It is one of the greatest trading pageants of all South America to-day. (Fig. 14.)

FIG. 14.
Market day and the principal plaza at Sacaba, Bolivia, near Cochabamba.

The town of Huynuni illustrates trade features similar to those at Cliza. It is 20 miles within the western edge of the eastern plateau, near the headwaters of a stream tributary to Lake Poopó. The elevation of the town is 13,000 feet and only barley and potatoes, llamas and sheep can be produced. The vegetables and other desired foods are imported from the valley of Llurivayi and others, 30 or 40 leagues east of Huynuni and at an elevation of 8,000-10,000 feet. It requires the greater part of a week to make the journey. There are regular market days sometimes once, some-

times twice a week in which the local vendors, in little booths, dispose of the cargoes. Purchases may be made on other days, but the stuff is apt to be inferior. One finds the market stocked with every variety of product—cabbages, lettuce, carrots, potatoes, oranges, many kinds of seeds, onions, salt, sugar, apple, peas, peanuts, meats, etc. Antequera, a mining town 7 leagues southwest of Huynuni, and numerous other mining centers in the plateau, are supplied in the same way from the eastern valleys.

For railroad, as for industrial purposes, the region possesses one unrivalled resource, its water power. Were the dynamic energy in the headwaters of Bolivia's streams properly utilized to-day there would be generated sufficient electrical power to run every railroad train now operated in the Republic, every one ever to be operated, every factory, every mine. It needs but a little attention to the subject to see that man has only to install a very few hydro-electrical plants, in strategic places, to carry goods easily up the different grades by the now unused waters that run down those grades. If it be argued that the limited commerce, as now developed, will not bear the expense, it is only necessary to point to two inevitable benefits: first, the enormous stimulation to production that such cheap and easy transportation would effect; and, second, the transference of electrical power from the eastern Andes to the central plateau is one of the sanest present-day possibilities and would at once eliminate that great expense of the plateau railroad, coal. The coal now burned there costs $20 to $30 per ton and the rate is ruinous. Bolivia's coal resources are practically nil. She must continue to import coal whose cost even at the centers of population is bound to suffer rapid increase in the near future. The water power of the Loa valley in Chile, generated at almost negligible expense, is now the substitute for expensive coal at Santa Fé, one of the greatest nitrate establishments in Chile. In Mexico a cable 110 miles long conveys the energy generated at a waterfall to mines near Durango. A dozen hydro-electrical plants in the United States generate power that is conveyed over comparable distances. There are, within 70 miles of Cochabamba, no less than a dozen never-failing streams, any one of which would carry the freight and passenger traffic and do the business of a city of 1,000,000 people. It is the folly of the industrial age that these sources of power should lie untouched in the very region where one may actually see Indian carriers bringing rough-hewn planks of tropical cedar wood laboriously on their backs, a week's journey over one of the most difficult trails in existence, to forestless Cochabamba

for the purpose of making furniture! What Bolivia needs to supply power and bring the products of the plains to her more densely inhabited plateau is not a great coal deposit, but dams. Coal deposits are exhaustible, but the water power of Bolivia's magnificently watered eastern slopes is as permanent as the slopes themselves, and while one in a geologic sense may describe these as ever-changing, in an anthropogeographic sense they are eternal. Anyone who sees in the lack of wood on the altiplano of Bolivia, and in the lack of coal throughout the Republic generally, a fundamental

FIG. 15.
Type of locomotive and freight car employed on the Antofagasta-Bolivia R. R. (meter gauge), 1907.

defect for any future industrial Bolivia is blind to the clear facts of easily accessible water power and its realized possibilities in other lands. The heavy machinery required for electrical plants of adequate size would be difficult of transport away from the railroad, but it can be made in lighter and more feasible units whose transport would be relatively easy of accomplishment. If pianos can be taken to Sucre and heavy rice threshers to Cochabamba, surely dam and dynamo equipment can be taken to sources of water power of such enormous importance and amount. (Fig. 15.)

(*To be concluded*)

THE NEW STAR IDENTIFICATION TABLES OF THE HYDROGRAPHIC OFFICE

BY

G. W. LITTLEHALES

The United States Hydrographic Office has just brought out, as a result of extensive and laborious computations, a convenient and important work in recognition of the value of observations of the stars and planets for the purpose of ascertaining the compass error and the geographical position of ships at sea and of the necessity of employing such observations in consequence of the increased speed of vessels employed in ocean transit. With every attempt to make ships go faster and get farther in a given time, greater frequency in determinations of geographical position become more important, because the reckoning of ships is rendered more and more uncertain, by the diverting forces of the elements, in proportion to the distance traversed from the latest ascertained position.

The navigator, able only to find his ship's position and the error of the compass by observations of the sun, has, therefore, but a limited and consequently, imperfect command of the art of navigation. In these days of keen competition, when the difference of a few tons of coal, or a few hours in the length of passage, may mean all the difference between profit and loss, or between safety and disaster, he must recognize the great advantage and extreme importance of employing also in his service the stars that "rule by night."

Sir John Herschel said: "Every well determined star, from the moment its place is registered, becomes to the astronomer, the geographer, the navigator, the surveyor, a point of departure which can never deceive or fail him, the same forever and in all places, of a delicacy so extreme as to be a test for every instrument yet invented by man, yet equally adapted for the most ordinary purposes; as available for regulating a town clock as for conducting a navy to the Indies; as effective for mapping down the intricacies of a petty barony as for adjusting the boundaries of Trans-Atlantic empires."

From remote antiquity, the heavens were mapped out into constellations and groups of stars in which, by the aid of a fertile imagination, some resemblance was traced to the various beasts, birds, fishes, and classical heroes whose names were assigned to them.

The most ancient records allude to the constellations by these distinctive names. In the Old Testament, in the book of Job, we read of the "bands of Orion" and "the sweet influence of the Pleiades"; and in the writings of Hesiod and Homer are names as familiar to the astronomer of to-day as they were to the observer in the ages when science was in its dawn. Besides the designation by name of the most conspicuous stars and of the groups or constellations, the stars in each constellation are distinguished for reference by letters and numbers; and in connection with the name or other distinguishing designation of each of them, astronomers have registered its place in the firmament by measured co-ordinates which are called declination and right ascension and which are somewhat comparable with latitude and longitude on the surface of the earth.

In finding any star in the heavens from a map of the constellations, it is necessary to refer to some one star or constellation as known, such as the Great Bear, also called by the Latin name Ursa Major, and then to recognize others in accordance with the configuration of the map; for, by supposing a line to pass through two such known stars, it may also pass through or near another star whose name is required; or by producing a line to a certain distance estimated by the eye, the same end is obtained.

Probably the reason why stellar observations have been so little practiced at sea is to be found in the extreme inconvenience, if not impossibility, of identifying the observed stars by means of star maps or by recognizing the configuration of the heavens. In stormy weather with partly clouded skies obscuring the arrangement of the constellations, the navigator was frequently prevented from recognizing any of the few stars showing at a time and hence from obtaining results at the very times when they might be most indispensable to his safety. How many sights have been found useless because the observer thought he was observing one star when in reality pointing his telescope at another? How many coveted results have escaped the navigator, because, on account of clouds obscuring its neighbors, he could not feel sure of the identity of the one star that was visible?

What the Hydrographic Office has done to relieve ocean commerce of the impediments thus arising is to pave the way for the unrestricted application of the science of astronomy to navigation by providing in simple tabular form the means for converting the altitude and approximate bearing of any star, which the navigator may measure with his sextant and compass, into the corresponding decli-

nation and right ascension, the co-ordinates by which they are catalogued in the lists giving the names and magnitudes of stars. The navigator is thus rendered independent of any previous knowledge of the constellations and the names of the stars he may observe, and, instead of being confined to the employment in his observations of those stars which he may be able to recognize, is enabled to identify any star that is bright enough to observe.

MAXIMUM, MINIMUM AND AVERAGE HYDROGRAPHS OF THE MISSISSIPPI RIVER*

BY

ROBERT M. BROWN
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The diagrams presented with this paper represent composite hydrographs of the Mississippi river at five stations and were compiled from the comprehensive hydrographs of the river from the time when the records were first tabulated to the present as printed in the Report of the Mississippi River Commission for the year ending June 30, 1909. In each illustration, the upper curve represents the absolute maximum stage of the river for the location; the lower curve, the absolute minimum; and the continuous line the average hydrograph. Figure 1 portrays the stages at Hannibal, Mo., on the Mississippi river; Figure 2, stages at Hermann, Mo., on the Missouri river; Figure 3, at St. Louis just below the confluence of the Upper Mississippi and the Missouri river; Figure 4, at Cairo, Illinois, on the Ohio river; and Figure 5, at Memphis, Tennessee, where the combined effect of the upper rivers is recorded.

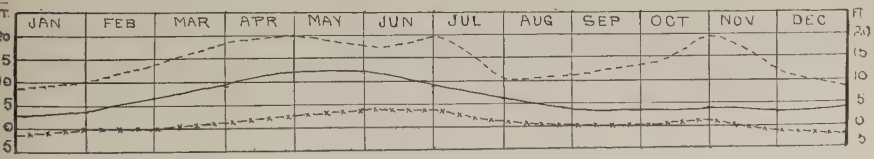

FIG. 1.

Figure 1. Hannibal. 329.4 miles above Cairo. Zero of gage is 469.60 feet above the Cairo Datum plane. These curves are taken

* Paper read before the Association of American Geographers at Boston, January, 1910.

from the records for twenty years, from 1879 to 1889. The average crest of the flood appears in May, a condition which arises from the Upper Missouri type of rainfall. This crest has arrived as early as the last of April and as late as July 1, and there has been a range of 16 feet during the twenty years. Exceptional occurrences may always arise as is indicated by the excessive height of the maximum curve during October and November. This departure from uniformity resulted from the high water stages during the fall of 1881.

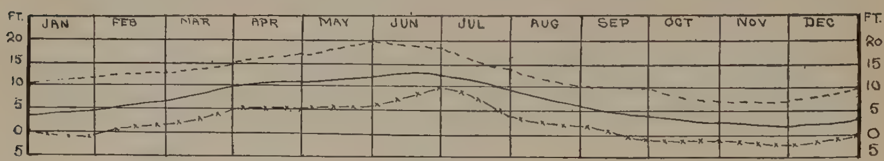

FIG. 2.

Figure 2. Hermann. Zero of gage is 502.17 feet above the Cairo Datum plane. These curves represent the same period of time as that of the Hannibal record. The average crest is seen to appear about June 20, a little later than that of the Upper Mississippi, and this flood is a result of the Lower Missouri type of rainfall. The 1897 season is represented on these curves by the absolute maximum for January 1 and April 1, and the absolute minimum for the months from August until the close of the year.

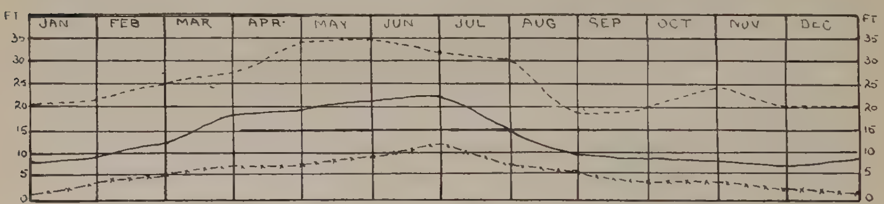

FIG. 3.

Figure 3. St. Louis. 190.8 miles above Cairo. Zero of gage is 400.22 feet above the Cairo Datum plane. These curves cover a period of twenty-nine years, from 1871 to 1899. The crest of the St. Louis flood, which is made up of a combination of the Missouri and Upper Mississippi river floods, is reached on the average during the last of June. In the absolute maximum we have a marked deviation in the October-November portion of the curve which is only in part explained by the corresponding excess in the Hannibal absolute

maximum curve. While the November 1 position of the absolute maximum curve is the result of the 1881 rise on the Upper Mississippi, the October 1 position has for its origin a combination of rises on the two tributary rivers during 1884. The high water of 1895 corresponds nearly with the absolute minimum curve for the months from January to July, and the entire absolute minimum curve does not differ much from the hydrograph for that year.

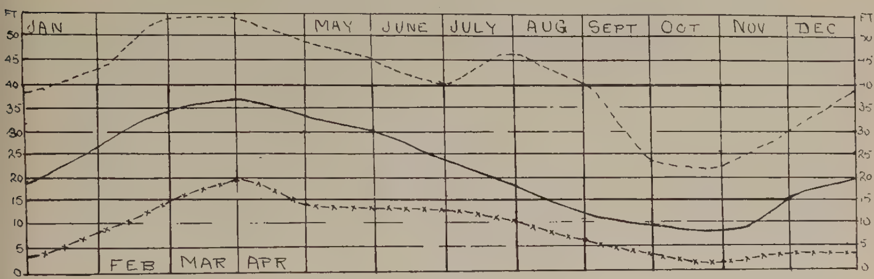

FIG. 4.

Figure 4. Cairo. 1 mile above Cairo. Zero of gage is 290.84 feet above the Cairo Datum plane. These curves cover a period of twenty-eight years from 1872 to 1899. The crest of this flood arrives on the average during March and results from the early winter rains in the Southern Appalachians. The excess in the absolute maximum during August and September is the record of the season of 1875. One other record for August approaches within thirteen feet of the August, 1875 record but no other reaches within twenty-one feet of it. At this station, during the twenty-eight years, the range of the season below average low water mark extends from August 15 to February 1. The 1894 low water season practically coincides with this minimum stage. The beginning of the high water season here may come as early as the last of October or be delayed until the first of January. On the other hand, stages above the average high water mark may be maintained from the last of December until early in September.

This uncertainty of the river stages at Cairo is a reflection of similar conditions among the tributaries of the Ohio, and offers a serious embarrassment to any effort towards impounding the waters in reservoirs.

Figure 5. Memphis. 230 miles below Cairo. Zero of gage is 184.27 feet above mean Gulf level (Cairo Datum is approximately 19.7 feet below mean Gulf level). These curves represent the com-

bination of the floods of the three tributaries on the lower river. Stages below the average low water mark are recorded from the last of July until the last of February, a period of seven months; while stages above the average high water mark are shown from the last

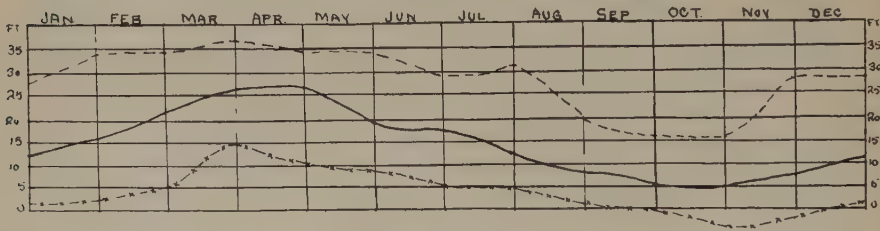

FIG. 5.

of November until the middle of August, over eight months. The lowest stages are recorded during October and November, and the highest during March and April. The high water rise may begin as early as November 1 or be delayed until March 1. A consistent fall in stage during August and September and a consistent rise during March are also recorded.

RECENT PUBLICATIONS OF THE WEATHER BUREAU

BY

R. DEC. WARD

The new series of publications dealing with the climatology of the United States, issued by the Weather Bureau, includes a number of bulletins. A ten-page summary of the climatological data for Maine ("Section 106," in the new classification), contains a brief account of the "climatic characteristics" of New England as a whole, with special reference to Maine; a series of tables of monthly and annual rainfalls for 22 stations (running back in one case to the year 1837); miscellaneous data, including average number of days with .01 inch or more of precipitation, mean temperatures, highest and lowest temperatures by months, average depth of snowfall, mean relative humidity, prevailing wind direction, and frost data; hydrographic data compiled from the records of the U. S. Geological Survey; a chart showing the comparative monthly distribution of precipitation for certain New England stations, and a map showing the boundaries

of the "sections," with the location of the principal reporting stations, drainage basins and general elevation above sea level.

The summary for "Section 105," which includes New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut, is similar in form and contents to that for Maine, just described. The precipitation record for Hanover, N. H., goes back to 1834; that for Burlington, Vt., to 1828; that for New Bedford, Mass., to 1814; that for Providence, R. I., to 1832, and that for New Haven, Conn., to 1804. All of these records, except those for New Bedford and Providence, have some breaks.

Summaries for "Sections" 1, 2, 3, 4, 49 and 87, range from Arizona and New Mexico to South Carolina. It does not appear on any of these summaries, how often they are to be issued, but we presume that they are to be published annually.

The first two numbers of the *Monthly Weather Review* in its new form (July and August, 1909) have also been issued. As has already been noted in the *Bulletin*, the *Review* will no longer contain general articles, of more or less popular interest, but will be confined chiefly to the publication of all the representative climatological data for the country as a whole. These data, grouped under the twelve new climatological districts, are preceded by a short account of the meteorological conditions for the month in question. The data are edited by local representatives familiar with the country, who prepare the monthly summaries made up from notes written by the several "section directors." The *Review* for July, 1909, embraces nearly 150 pages, and is therefore much larger than the old numbers. Professor F. H. Bigelow is in charge of the Climatological Division of the Weather Bureau, and Dr. Cleveland Abbe, Jr., is Assistant Editor of the *Review*. It is gratifying to see the discussion of certain phenomena of special interest during the month of July last, as, for example, of summer hot winds in Oklahoma; of the Texas hurricane of July 21, with a chart of the track of the storm and of the limits of damage, and with views of the Galveston sea wall, which did such effective service in protecting the city. Those who wish to keep in touch with current meteorological phenomena, as well as all persons who for any purpose desire to secure current climatological data, will need to make regular use of the new *Monthly Weather Review*. The librarian of the Weather Bureau, Mr. C. F. Talman, continues his bibliographic notes in the new *Review*.

The August, 1909, issue, is in general similar to that for July, but contains several charts which were not included in the July num-

ber. These charts show the total precipitation and the departures of the mean temperatures from the normal for each district; the total precipitation, the percentage of clear sky between sunrise and sunset, and the sea level isobars, isotherms and prevailing winds for the United States as a whole; and the tracks of anticyclones and cyclones, for August.

EDITORIAL NOTES AND COMMENT

A well-known arctic explorer has written to the Society to ask why two different latitudes are given in some of the best atlases for the highest north attained by Nansen. The fact is that more than two different statements as to his highest north have appeared in authoritative publications.

On April 7, 1895, Nansen's observations showed that he had much surpassed the highest previous record but, in his book, he makes no more account of this achievement than of any other position along his route. The fine map made by Bartholomew for the English edition of the book does not even give the latitude figures of his highest north. The explorer wrote in "Farthest North" that he had reached "about 86° 10′ N.;" and the English edition of his book adds, in a footnote, that on further calculation, his northmost point was 86° 13.6′.

Later still, Vol. 2 of Nansen's "Scientific Results" gave 86° 12.8′ as his highest point of observation and added that he walked about a mile further north. Stieler's Hand-Atlas takes this walk into account and gives Nansen 86° 14′ N.; Andrée's Hand-Atlas gives 86° 4′, perhaps a misprint; and the last edition of Greely's "Handbook" gives 86° 12′.

Large scale maps showing the distribution of edible shellfish along the coasts of France have been in course of publication, for four years, in the *Bulletin* de l'Institut océanographique de Monaco. The laborious researches they record have been a work of love by two enthusiastic men of science, Prof. Joubin and Mr. Guérin, who hope, in two years more, to complete the mapping of the beds of shellfish on all the French coasts.

They were so fortunate as to secure the interest of a princely

patron who has spared no expense to produce these colored maps in the best cartographic style. The maps were possible because the Prince of Monaco paid the bills. He has thus given one more proof, amid his oceanographic researches, of his helpfulness in the development of maritime industries.

Albert I, Prince of Monaco, is widely known as an indefatigable student of the sea. His personality, however, has been best revealed in the book he published in 1905, "La Carrière d'un Navigateur" in which we see the man, as well as the scientist; for we get from it more than a mere inkling of the temperament and aspirations that have shaped his career. As the *Bulletin* said of the book, "it tells us of his views on many things, of his philosophic notions, and of his conviction that life is too serious to be spent in frivolity, a thought that was the basis of his determination to be a sailor and an oceanographer."

Nothing more impressively illustrates our advancing knowledge of the various conditions of the oceans than the twelve colored maps (*Annal. d. Hydrog. u. Maritim. Met.*, Vol. 38, No. 1, 1910), showing what we now know of the temperature of the Pacific waters at the surface and at ten different depths, down to 4,000 meters. The scientific expeditions of the leading nations have, for many years, been collecting the observational material that is now so well expressed on many maps and charts. Not a few school wall maps are beginning to illustrate these facts so adequately that they are a great help to teachers in their class room talks on the oceans, their islands and their relation to the lands.

The various tints for depths show clearly that all the oceanic islands of the Pacific, for example, rise not from the deeps but are the culminating points of submarine ridges whose shape and extent are indicated on the maps, as far as our present knowledge goes; that the great complex of islands to the northeast and north of Australia stand on a submarine plateau which is connected with the continent and is believed to have once been a part of it; and, farther south, are observed the comparatively shallow waters, between Australia and South America, dotted here and there with islands, the submerged plateau on which they stand, suggesting a possible former land connection between the two continents. The width of the continental shelf along most coasts is now fairly well known and adds a new detail to maps of the oceans; and since the return of the Bruce expedition from Coats Land, the maps have

been able to show that the great submarine ridge, discovered when the first trans-ocean cables were laid, extends through the mid-Atlantic practically from Arctic to Antarctic waters. On the whole, the maps of the seas of the past twenty years, show improvement that is almost commensurate with that of the maps of land areas.

Mr. Herbert A. Dodge of Crystal Lake, Illinois, has presented the Society with a copy of Emil von Sydow's Schul-Atlas of 1866. This was eighteen years after the distinguished German geographer prepared the first issue of his small school atlas. It was an epoch-making book for the new ideas it embraced came, in time, to be recognized as the fundamental principles upon which school maps should be based; and from that time to the present, Sydow's Schul-Atlas and the Sydow-Wagner Methodischer Schul-Atlas, which succeeded it in 1889, thirteen years after Sydow's death, have stood in the forefront of school atlases. No other map product has more clearly and instructively illustrated the story of the steady progress of the cartographic art than the work which Sydow began, under the auspices of Justus Perthes, and which Dr. Hermann Wagner and the Perthes cartographers have so ably carried on.

Sydow introduced the revolutionary idea that school maps should tell children something more of geography than merely its political phases. Maps should picture as well the mountains, valleys and plains. Cartographic expression should be given to the land forms and the map should help the teacher to show what the surface of the earth is really like. Sydow's atlas introduced other innovations, but this was the fundamental idea and it has been steadily developed with the wonderful growth and improvement of map symbolism for the expression of a large variety of facts.

This interesting example of the eighteenth edition is not more than half as large as the atlas of to-day; but the contrast in size is no measure of the vast improvement in map expression, and in the content of geographical knowledge to be expressed, that are now seen in this and many other school atlases whose makers have followed in the path that Sydow blazed.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

ANNUAL MEETING OF THE SOCIETY. The Annual Meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday, January 25th, 1910, at 8:30 P. M.

Vice-President Greenough in the chair.

The following persons, recommended by the Council, were elected Fellows:

Felix H. Hunicke,	Albert B. Lord,
Miss Ella Huntting,	Abram G. Nesbitt,

Adolph Rusch, Jr.

REPORT OF THE COUNCIL

The Annual Report of the Council was presented and read by its Recording Secretary, Mr. Levi Holbrook:

NEW YORK, January 20, 1910.

To the American Geographical Society:

The Council respectfully submits the following report for the year 1909:

The number of Fellows on the 1st of January was 1,238. The additions during the year were 116. The losses by death, resignation, etc., were 100 and the total Fellowship on December 31st was 1,254, of which number 360 were Life Fellows.

There have been added to the Library 930 books, 3,780 periodicals and pamphlets, 1,112 maps and charts, and 13 atlases.

Seven meetings of the Society were held, at which addresses were made by

Mr. Herman Montagu Donner,	Professor William Morris Davis,
Miss Annie S. Peck,	Dr. Frederick Jones Bliss,
Mr. Arnold Henry Savage Landor,	Professor Charles Ernest Fay,

Commander Robert E. Peary.

The Cullum Geographical Medal has been awarded to Francisco P. Moreno for his work in the Andes and Patagonia; and to Ernest H. Shackleton for his explorations in the Antarctic.

The Charles P. Daly Medal has been awarded to William W. Rockhill for his travels and researches in China, Mongolia and Tibet; and to Charles Chaillé-Long for explorations and discoveries made by him in Africa.

There have been published in the *Bulletin,* besides the Geographical Record, the Scientific Notes, the Book Reviews and Bibliographical Lists, thirty-seven original papers. It is proposed to enlarge and improve the *Bulletin* during the coming year.

The Collection of maps and other appliances used by teachers of geography in European schools, which was made by this Society and exhibited in New York in 1908, has since been shown at the State Universities of Wisconsin, Minnesota, Ohio, and Michigan, the Universities of Chicago and Cincinnati, Denison University, Granville, O., and the State Normal College of Michigan, and has now been forwarded to the Pacific Coast. The demand for the exhibition from Universities, Colleges and Schools in the West, South and East, has been and continues gratifying, and letters from the various exhibitors testify to the educational value of the study of this material.

At the request of the Hudson-Fulton Celebration Commission the Society's collection of books, maps, etc., relating to Henry Hudson, Robert Fulton and their Times was exhibited, at No. 15 West 81st Street, during September and October and attracted many visitors.

The Society has received ten thousand dollars bequeathed to it, for its corporate purposes, by its late Fellow William R. Sands; and the sum has been invested in bonds, secured by mortgage of Real Estate in New York City.

The year 1909 has been a memorable one in the history of the Society. Its President, Mr. Archer M. Huntington, had for some time been impressed with the fact that the building No. 15 West 81st Street, although of recent and substantial construction and very beautiful, was fast becoming inadequate to the growing needs of the Society. On June 22nd, Mrs. Collis P. Huntington most generously conveyed to him, to be transferred to the American Geographical Society, free of all cost, a lot of land at the corner of Broadway and 156th Street, measuring 125 by 100 feet; and this land Mr. Archer M. Huntington has deeded to the Society for its permanent occupancy, stipulating only that there shall be erected thereon a building, the architecture of which shall harmonize with that of the Hispanic Society of America, which is in the immediate neighborhood. The Council accepted this magnificent gift with gratitude and enthusiasm; feeling that such an opportunity to secure for the Society a permanent, adequate and commodious home ought not to be neglected. The site may seem to some a little remote; but it is really very easily reached, and the city is constantly and rapidly growing in that direction. Already it is reached by subway, in 7 minutes from Columbia University, in 19 minutes from the new Public Library and the centre of the residential district at 42nd Street, and in 29½ minutes from Wall Street, the business centre of the town. Plans have been carefully prepared by Mr. Charles P. Huntington, Architect, for a building 125 feet on 156th Street and 65 feet on Broadway, which will be handsome, dignified, imposing and thoroughly well adapted to the purposes of the Society. When completed it will be an ornament to the City and a credit to the Society, its President and all concerned.

A special Building Fund has been established to which members of the Council and friends of the Society have already subscribed $83,000; and it is hoped that their generous example will be followed by others and the new building thus become a gift to the Society—leaving all of its present property intact, and the income therefrom available for current expenses. Building operations are now in progress and it is proposed to continue them so long as there is money in the special Building Fund. Operations to cease when that special fund shall be exhausted; to be resumed when the Fund shall have been replenished; and so forth and so on. Fellows of the Society have so recently made generous contributions for building purposes that the Council is reluctant to appeal to them again at this time; but all friends of the Society are informed that monies are needed for the completion of the new building, and that contributions to the Building Fund will be thankfully received.

For the general financial condition of the Society reference is made to the report of the Treasurer which is herewith presented.

All of which is respectfully submitted.

CHANDLER ROBBINS,
Chairman.

LEVI HOLBROOK,
Secretary.

Report of the Treasurer

The Report of the Treasurer, Mr. Henry Parish, Jr., for the year 1909, was read, in his absence, by Vice-President Greenough:

General Account

The Treasurer respectfully reports:

On January 1st, 1909, there was on hand a balance of..		$4,602.20
During the year there have been received for Fellowship Dues, Sales of Publications, Interest on Investments, &c.	$23,323.78	
Legacy from the Estate of William R. Sands..........	$10,000.00	$33,323.78
Total........		$37,925.98
There have been expended for Salaries, Meetings, Library, Publications, House Expenses, Insurance, Postage, &c.	$20,891.27	
Invested in guaranteed mortgages....................	$14,650.00	$35,541.27
Balance December 31st, 1909....................		$2,384.71

The Reports of the Council and the Treasurer were approved and ordered on file.

The Report of the Special Committee, charged with the duty of selecting candidates for the offices to be filled, was presented and read:

New York, January 20th, 1910.

The Special Committee, appointed November 18, 1909, to nominate and recommend to the Society suitable persons to be elected in January, 1910, to fill vacancies then existing in its offices, reports that it recommends the election of the following-named persons to the offices designated:

President,	ARCHER M. HUNTINGTON,	term to expire in 1911
Vice-President,	J. HAMPDEN ROBB,	" " 1913
Treasurer,	HENRY PARISH, JR.,	" " 1911
Recording Secretary,	HAMILTON F. KEAN,	" 1913
Councillors,	ANDREW G. AGNEW,	
	FRANK BAILEY,	
	LEVI HOLBROOK,	" 1913
	CHARLES A. PEABODY,	
	PAUL TUCKERMAN,	

Respectfully submitted,

JOHN GREENOUGH,
ARCHIBALD D. RUSSELL, *Committee.*
HAMILTON F. KEAN,

The vote of the Society was unanimously in favor of the persons recommended by the Council, and they were declared duly elected.

Vice-President Greenough then introduced the speaker of the evening, Rear

Admiral Colby M. Chester, U. S. N., retired, who addressed the Society on "Regenerated Turkey." Stereopticon views were shown.

On motion, the Society adjourned.

Presentation of the Cullum Geographical Medal to Dr. Moreno. The Cullum Geographical Medal, awarded to Dr. Francisco P. Moreno of the Argentine Republic, was formally presented to him, on Sept. 4, in behalf of the American Geographical Society, by the Hon. C. H. Sherill, Minister of the United States to Argentina. The presentation took place in the American Legation in Buenos Aires and was attended by thirty of the leading men of science of Argentina. In delivering the medal to Dr. Moreno, Minister Sherill paid high tribute to his achievements in the fields of geography and anthropology.

In reply to Mr. Sherill's remarks, Dr. Moreno expressed his profound gratitude for the honor conferred upon him by the American Geographical Society. He added that the occasion also evoked most grateful memories of the men who had assisted in the long labors for which he had received this signal distinction and of the famous secretaries of the Smithsonian Institution, whose advice and encouragement had always been most helpful.

Dr. Moreno has, for some months past, been active in the promotion of the International American Scientific Congress which will meet in Buenos Aires, this year, to celebrate the 100th anniversary of the Declaration of Independence of Argentina. He writes to the Society that he believes this Congress will help largely "to cement friendly relations between the United States and Argentina and be the means of further increasing mutual knowledge of their physical, economic, and social conditions."

NORTH AMERICA

Exploration of the Mount McKinley Region. Professor Herschel C. Parker, J. H. Cuntz, and Belmore H. Browne, all Fellows of this Society, expect to spend the approaching summer in the Mount McKinley region of Alaska. While they intend to climb Mount McKinley, if practicable, their principal work will be the scientific exploration of this little known region. They will accordingly be fully equipped with instruments to record the topography and hypsometry of the mountains and glaciers. They intend to spend from one to two and a half months on the ice and snow above the line of vegetation and to make photographic studies of the conditions they find there. For this purpose the party is being equipped with a complete outfit suited to high altitudes and arctic conditions. The party will ascend the Sushitna River, explore the difficult southern approach to Mount McKinley and it is likely that an effort to ascend these mountains will be made on its southern side. As the expedition will go north for scientific work in one of the most difficult mountain regions of Alaska and will be under the leadership of Prof. Parker, whose large mountaineering experience is well known, its purposes have been approved by our Council and the work will be done under the auspices of the Society.

Survey of Mount Baker Quadrangle. The topographic survey of the Mount Baker quadrangle, in the State of Washington, was completed last fall. The survey party was under the direction of J. E. Blackburn. In the course of the work Mr. Blackburn, with E. H. Jones, T. L. Duncan, and C. V. Guerin,

climbed Mount Baker, from whose slopes and summit observations were made and mapping was done.

Mr. Blackburn says that the whole mountain is an almost unbroken glacier, only narrow rocky dikes protruding here and there through the vast ice mass. This glacial ice, constantly augmented by snowfall, accumulates in a number of huge gorges, forming glaciers that move down the mountain sides for several miles before melting. Thus the ends or lower boundaries of the glaciers are about 3,700 feet above sea level, whereas the altitude of the dome of Mount Baker is 10,745 feet. The climb to this summit was made in four hours by the topographic party from its last camp, which was pitched at an elevation of 5,200 feet.

Mount Baker was long ago one of the active volcanoes of the Cascade Range, and the steam issuing from the vents of its crater to-day show that its internal fires are not yet entirely dead. The crater is about 1,000 feet below the main dome of the mountain, and this last lap of the climb proved by far the hardest. Mr. Blackburn describes the summit as a table having an area of about 60 acres.

Progress of the U. S. Geological Survey. The Thirtieth Annual *Report* of the Director of the U. S. Geological Survey for the fiscal year 1909 has just been issued. It announces that large areas that had been withdrawn from entry pending determination of their mineral or non-mineral character, were restored to agricultural entry after examination, and selling prices were placed on 1,500,000 acres of coal land. On information furnished by the Survey, lands available for water-power sites on 26 rivers in the Western States were withdrawn from entry.

Nearly 24,000 square miles were topographically surveyed. About 36 per cent. of the country has now been mapped in detail. Work on maps for an atlas of national forests was continued. Thirty folios covering as many national forests were finished and 19 others were nearly completed.

Work on the map of the United States, on a scale of 1:1,000,000, was begun during the year. This will form a part of the world map that is now in preparation under international agreement between several countries. Topographic and geologic surveys were made in Alaska of areas exceeding 4,000 and 5,000 square miles, respectively. Two of the copper-bearing belts of southeastern Alaska were mapped in detail and the copper and gold-bearing belt extending from the head of Copper River to White River was covered by a reconnaissance survey. Gold deposits, coal beds, and water resources of parts of Alaska were also studied, and statistics were collected to show the mineral production of the Territory.

Geologic work was done in all parts of the country, the investigations including the iron ores of New Jersey, Virginia, Alabama, Georgia, and Tennessee; the lead and zinc deposits and industry of the Mississippi Valley; the coal beds of Indiana, Illinois, Colorado, Utah, Montana, and Wyoming; the oil fields of Louisiana, Texas, Arkansas, Oklahoma, Colorado, Nevada and California; the peat deposits of Maine; the phosphates of Idaho and Wyoming; deposits of mica, manganese, copper, tin, tungsten, and tantalum in Western States; mineral paint ores in Pennsylvania; granites in New England, and building stones in Arizona.

Mining districts in Colorado, Utah, Arizona, Nevada, and Oregon were investigated. Co-operation with many States in geologic work was continued, and

progress was made on the geologic atlas of the United States. The work on water resources comprised stream gauging at 829 stations. Examinations of underground water resources were made and co-operation with many States in these investigations was continued.

During the year 134 books and pamphlets and 289 maps were published. The Survey's maps now comprise nearly 1,800 sheets of the standard size, covering that many separate areas in different parts of the country. Nearly a million publications were sent out, of which about 450,000 were sold.

MISSOURI GEOLOGICAL REPORTS. "The Geology of Morgan County" by Professor C. F. Marbut, is the third of the series of detailed county geological reports issued by the Missouri Bureau of Geology and Mines which are to cover all the counties of the state. In addition to the geological detail the author has presented a clear exposition of the economic resources of the county. A map in colors shows the distribution of rock formations in addition to cultural detail.

"The Geology of Pike County" is by Mr. R. R. Rowley, who had long studied the palæontology of Pike County. He has established the horizons in which certain groups of fossils occur, the geological sections for the county and he accompanies the report with a geological map.

Probably the most important report yet issued by the Missouri Bureau of Geology and Mines is "Geology of the Disseminated Lead Deposits of François and Washington Counties" by Dr. Ernest R. Buckley, to which Vol. IX (Parts 1, and 2) is given. The report adds to our knowledge of one of the most important deposits of lead ore in the United States. Attention is especially directed to the geological history of the area in its relation to the ore deposits. The large amount of illustrative matter includes photographic views, maps in colors, and many profiles, sections, etc. Part 2 is given entirely to 117 plates.

FLORIDA STATE GEOLOGICAL SURVEY. The second annual *Report* of this Survey has been published under the supervision of E. H. Sellards, State Geologist. It includes a report on the mineral industries and a report on the geology of Florida, with special reference to stratigraphy, to which is added a chapter on the topography and geology of southern Florida. The report of stratigraphy was prepared in co-operation with the U. S. Geol. Sur., in accordance with the agreement of 1907. The *Report* is illustrated with half tones and accompanied by a geological map of the state in colors (See New Maps, p. 152).

BANQUET OF THE GEOGRAPHICAL SOCIETY OF CHICAGO. The annual banquet of the Geographic Society of Chicago was held at the La Salle Hotel on Jan. 26, 1910. Six hundred persons participated. The guests of honor were Prof. T. C. Chamberlin of the University of Chicago and Commander Robert E. Peary, U. S. N., to each of whom the Society presented its Helen Culver gold medal. Miss Culver was herself at the speakers' table.

The President of the Society, Mr. Jesse L. Smith, made the opening address. President Harry Pratt Judson of the University of Chicago was the toastmaster. Prof. U. S. Grant of Northwestern University made the speech, presenting the medal to Prof. Chamberlin. The inscription on the medal read:

"Presented, April 26, 1910, to Professor Thomas C. Chamberlin for distinguished contributions to the principles of dynamic geography and for the planetesimal hypothesis from which they spring."

Prof. Chamberlin expressed his pleasure in the honor conferred by his co-workers in the science of geography.

The address of presentation for Commander Peary was made by Prof. R. D. Salisbury of the University of Chicago. The inscription on this medal read:

"Presented, April 26, 1910, to Commander R. E. Peary, U. S. N., for distinguished services in arctic exploration, and for the first achievement of the North Pole, April 6, 1909."

In Commander Peary's response he gave a brief résumé of his many years of continued effort, with its failures and final success. He expressed his keen gratitude for the recognition and approval of the Society.

SOUTH AMERICA

The Chilean Census of 1907. The figures for this census, which was taken on Nov. 28, 1907, have just been published by the Government under the title "Sinopsis Estadistica Jeográfica de Chile en 1907" (Santiago, 1909). The 23 provinces and the Magellan Territory have an area of 758,206 square kilometers, a population of 3,254,451, giving a density of 4.2 to the square kilometer. The most populous provinces are Santiago, 517,648; Valparaiso, 281,872; Concepcion, 217,393; Coquimbo, 175,149; Nuble, 166,340; Colchagua, 159,119; Cautin, 140,159; Aconcagua, 128,644; Valdivia, 118,842. Foreigners number 134,524, of whom 72,378 are Europeans (including 18,755 Spaniards, 13,023 Italians, 10,724 Germans, 9,845 English and 9,800 French); and 58,118 Americans (including 27,140 from Peru, 21,968 from Bolivia, 6,956 from Argentina and 1,055 from the United States). The Chinese number 1,920 and the Araucanian Indians, 101,118. The cities with more than 20,000 inhabitants are Santiago (332,724), Valparaiso (162,447), Concepcion (55,330), Iquique (40,171), Talca (38,040), Chillan 34,269), Antofagasta (32,496), Viña del Mar (26,262).

AFRICA

Another Link in the Cape to Cairo R.R. A despatch from Khartum (*London Times,* Weekly Edition, Dec. 31, 1909), said that on Jan. 1, 1910, another section of the railroad on the Cape to Cairo route would be opened to traffic. The road had been extended from Khartum, along the west bank of the Blue Nile, to the south-east and had reached Wad Medani, on that river, 120 miles from Khartum. Wad Medani is an important town on the Blue Nile, the headquarters of the Governor of the Blue Nile province and of one of the Sudanese regiments. According to the plan adopted some years ago, the Cape to Cairo railroad is to extend eastward towards the Abyssinian frontier in order to avoid the wide, marshy region along the White Nile.

ASIA

Completion of the Peking-Kalgan R.R. This railroad, the first to be built by Chinese engineers and with Chinese money, was opened on Oct. 2, 1909. This is the first section of the line that is to extend west from Kalgan, along the edge of the high plateau of Mongolia to Kwei-hwa-tshöng and thence to Hokau on the great northern bend of the Hoang river. This extension from Kalgan will be about 250 miles long and is to be completed in seven years. China proposes,

later to extend a railroad from Kalgan across Mongolia to Kiachta, on the southern border of Siberia, also to be built by Chinese engineers. This line will follow an old caravan route through the wastes of northern Mongolia. The Russians propose to build a line from their Trans-Siberian line, south of Lake Baikal, to Kiachta and, when these two projects are carried out, there will be a new and much shorter rail route between the European markets and the Far East than that provided by the Siberian-Manchurian lines through Harbin.

Kalgan, the present terminus of the line from Peking to the west, is a large city and the most important trading point, northwest of Peking, along the edge of the Mongolian plain. Even in Marco Polo's day the region it occupies was known, far and wide, for its vineyards and orchards. The new line passes through a very fruitful and populous country, inhabited chiefly by Mohammedans. It is expected that the railroad across Mongolia will greatly stimulate Chinese immigration into that region. (*Geog. Zeitsch.*, Vol. 15, p. 705.)

Meanwhile, according to *Globus* (Vol. 96, p. 370), the Chinese government will establish an automobile line through the Gobi Waste between Kalgan and Urga with the special purpose of using freight motors instead of camel caravans in the tea trade.

Dr. F. J. Bliss's Lecture Before the Society. In his lecture "A Palestine Pilgrimage," before the Society, on Nov. 23, Dr. F. J. Bliss, for ten years Field-Officer of the Palestine Exploration Fund of London, touched only incidentally on his own specialty of archæological discovery, though he explained the results and some of the methods of recent excavations. Thus, before reaching Jerusalem, the audience saw, with the aid of the lantern, the massive monoliths, constituting the Pre-Israelite High-Place recently excavated at the site of Gezer by Mr. R. A. S. Macalister, a former colleague of Dr. Bliss. These pillars were doubtless standing when Gezer became part of the dowry of Pharaoh's daughter, at the time of her marriage to Solomon. At Jerusalem, he gave a view of the shaft dug by Sir Charles Warren, over 40 years ago, which revealed the colossal foundation stones of the Jewish Temple, 80 feet below the present surface. The excavations conducted by Dr. Bliss and Mr. A. C. Dickie of London, in 1894-1897, were also illustrated by plans and views, showing the recovery of the remains of ancient city-ramparts, with gates and towers, some of which are probably identical with those besieged by Titus. The original lines of the once arcaded Pool of Siloam were also recovered, with a magnificent flight of steps leading to it, and a church subsequently built over it—a church which was first described by a pilgrim of the sixth century, and which disappears from history about the time Columbus discovered America.

Later a side-excursion was made to the Low-Country between the Judean Hills and The Philistine Plain, for the purpose of seeing the sites where the lecturer excavated several ancient towns. Prominent among these was the mound of Lachish—one of the first places taken by Joshua—whose 60 feet of accumulated debris were proven, by careful and minute excavations during four seasons, to conceal the remains of eight superimposed towns, covering a period of some 1,200 years, beginning in early Pre-Israelite times and terminating with the Greek era. Ground plans of some of the towns were shown, together with views of pottery and other finds. Only the barest outlines of the work could be indicated, while the recent excavations of the Austrians at Jericho, with the present

work now being carried on by the Harvard Expedition at Samaria, were merely mentioned. The main theme of the lecture followed the well-known paths of Palestine travel.

AUSTRALASIA AND OCEANIA

PROF. DR. NEUHAUSS IN KAISER WILHELM LAND. A letter from this explorer written at Sissanu, in Kaiser Wilhelm Land near the Dutch New Guinea border, on Sept. 10, 1909, is published in the *Zeitschrift* of the Berlin Geographical Society (No. 10, 1909, pp. 689-90). He set out, with missionary Keysser, in January, last year, from the Sattel-Berge near Finsch Haven, for a journey of 40 miles into the interior through a wholly unexplored region. He found it a wild mountain land, very difficult to traverse, as the faint, native paths lead continually up and down the almost precipitous slopes of the mountains, many of the ascents and descents being over 3,000 feet. The villages of the blacks were found as high as 4,580 feet above the sea and the region was far more populous than had been supposed. He crossed the large Bulessom river which empties into Huon Gulf, over 30 miles north of its mouth. He made route surveys, many observations for heights and collected cartographic data which have enabled him to make a map of nearly the whole of Kai Land as the southeastern peninsula of Kaiser Wilhelm Land is called.

Later, he found distinct traces of former glaciation along the coast of Huon Gulf to the south of the Markham river mouth. In May and June he made two journeys up the Markham river and established the fact that it is navigable by the flat bottom boats of the natives for at least 60 miles. On account of the hostility of natives living around Lake Womba, the river had not hitherto been ascended by Europeans more than 18 miles. It does not lose itself in swamps, as had been supposed, but maintains a breadth of over 300 feet with a depth, in part, of 10 to 13 feet and its wide valley (up to 19 miles) between high mountain chains, is well populated.

The explorer says that, at Sissanu, an earthquake, in December, 1907, caused important surface changes. A coastal strip some miles in length sank several meters so that many palm trees, now dead, are half submerged.

NEW ZEALAND GEOLOGICAL SURVEY. This Survey has published *Bull.* 7 (New Series), on "The Geology of the Queenstown Subdivision, Western Otago Division," by Prof. James Park, who was engaged for five months in the study of this mining region, among the finest of the New Zealand Alps in South Island. The report contains 112 pp. of text, with many superior illustrations and maps. It includes an investigation of the configuration and physical features of the land, with special attention to evidences of former glaciation; and studies of the rock formations and geological structure, the nature and extent of gold-bearing alluvial drifts and lodes at Macetown, Skipper's and Arrow and the water supply.

POLAR

CAPT. BERNIER IN THE AMERICAN ARCTIC. Captain J. C. Bernier sailed from Quebec on the Canadian polar steamer, the *Arctic* (formerly the *Gauss*), on July 28, 1908. He had as scientific assistants, Prof. J. MacMillan, geologist, and W. E. Jackson, meteorologist, the latter being expected to take magnetic

observations at the winter quarters. Dr. Joseph Bolduc was the physician of the party. A quick journey was first made to Etah, near Smith Sound, to leave some supplies for Dr. Cook. Capt. Bernier then passed through Lancaster Sound, made a short stop in Erebus Bay, on the south coast of North Devon, Barrow Strait, and then, through Melville Sound, he reached Melville Island where he passed the winter of 1908-9 at the spot where Parry had wintered in 1820.

Last spring a sledge party was sent westward to Banks Land whose eastern shores were reached on April 26, after 20 days of travel. The coal outcrops on the north coast of Banks Land, discovered by Dr. Hamilton in 1856, were also visited and also the cairn erected by McClure in 1853 on Dealy Island. This depôt was found to be despoiled of everything excepting a little coal and some pieces of canvas. The records left by Parry were found and brought back and also a pole used by Sir John Franklin. Capt. Bernier says that if his instructions had not limited him, he might easily have made the northwest passage once more.

He took formal possession of the whole archipelago from 60° to 140° W. and up to the North Pole (?), including the islands discovered by the Norwegian Sverdrup. He found on Melville Island many musk-ox, reindeer, wolves and foxes, besides some polar bears and seals along the coast.

On Aug. 12, 1909, after 11 months in the archipelago, the expedition sailed from Melville Island and reached Quebec on Oct. 5. According to the report of a luncheon given to Capt. Bernier (Ottawa *Citizen,* Oct. 18), Sir Wilfrid Laurier, who was present, expressed the hope that Capt. Bernier would be ready to start again in 1910 with the same ship and crew, and promised that a free hand would be given to him to go to whatever latitude he found possible.

THE NORTHEAST PASSAGE. The Russian government has long believed that it may be found to be practicable to use the Northeast Passage as a sea route, especially for war vessels. This probability is believed to have been already demonstrated in the western part of the Asian Arctic Ocean. In November last the ice breakers Taimyr and Waigatch sailed from St. Petersburg for Vladivostock with the intention, next summer, of entering the Arctic Ocean through Bering Strait and studying this question along the northeastern coast of Asia.

DR. V. PIETSCHMANN IN WEST GREENLAND. This well-known Vienna zoologist has returned from West Greenland where his attention was especially given to the collection of the lower forms of life in the ocean waters. He has brought home 9 boxes of prepared specimens for the k. k. Naturhistorisches Hofmuseum.

THE SWISS-GERMAN GREENLAND EXPEDITION. The scientific members of this expedition (1909) were Dr. A. Stolberg of Strassburg and Dr. E. Baebler and Dr. A. de Quervain of Zürich. They made investigations of the upper air with the aid of 60 pilot balloons; took salinity measurements during the ocean voyage and in Godthaab Harbor; secured specimens of the sea bottom in this fiord; made measurements of evaporation and of carbonic acid in the atmosphere, the first researches of the kind in that latitude; studied some low forms of life in relation to similar work in the Alps; and travelled over the inland ice for about 60 miles from its edge, mapping its surface forms wth the aid of a theodolite and discovering, about 50 miles from the edge, a great system of crevasses. (*Pet. Mitt.,* Vol. 55, No. 12, p. 374, 1909.)

Does Novaya Zemlya Consist of Three Islands? The expedition sent to Novaya Zemlya by Gov. Sosnowsky returned to Archangel at the end of September bringing the surprising information that in Cross Bay they had discovered a waterway which extended clear across to the Kara Sea; thus they were able to prove that Novaya Zemlya consists of three instead of two islands.

Surveying the North Coast of Siberia. The *Bulletin* reported (Vol. 41, p. 384) the sending of an expedition by the Imperial Russian Academy of Sciences for the survey of the northern coast of Siberia from the Lena delta to Bering Strait. It is now learned (*Pet. Mitt.,* Vol. 55, p. 372) that the western section of the party, under the geologist, U. A. Volossovitch, has completed the survey between the Lena and Kolyma rivers. It is not surprising that many new indentations have been discovered since the only survey along this coast was made by Dim. Laptef on shipboard, in 1739-42, excepting the stretch between the Indigirka and the Kolyma which was examined in 1823. New proofs were found of the shallow depths of the Arctic Ocean along this coast.

The Norwegian Expedition to Spitzbergen. Captain Isachsen's expedition to Spitzbergen returned to Christiania on Sept. 18, 1909, after a very successful season of field work. The 15 men in the party, including two geologists and two topographers, sailed from Norway about the middle of June. The topographers were busy till the middle of August on the west coast of the main island between Ice Fiord and King Bay and also on the coast and in the interior of Prince Charles Foreland. Their work in the latter part of August was on the north side of the main island between Dane Island and Wood Bay. The geologists were at work in July in Prince Charles Foreland, on the coast to the east of Foreland Sound and on the peninsula between English and King Bays. In August, the rates of movement and recession of Lilliehoek Glacier were ascertained and the crystalline schists and eruptive rocks of the interior were studied; also the Devonian formation between Red and Liefde Bays and on Reindeer Peninsula. Early in September, the entire party were at work on both sides of Foreland Sound and in Green Harbor. The vessel, meanwhile, made soundings in King Bay and in the northern part of Foreland Sound. The weather was not very favorable for topographic work, as fog and rain prevailed. The summer season was late. Foreland Sound was not free of ice till the middle of July, a month later than usual. Ice was fast to the north coast throughout the summer. (*Globus,* Vol. 96, p. 370.)

Shackleton Will Not Return to the Antarctic. Sir Ernest Shackleton denies the rumor that he will head another expedition to the Antarctic in the immediate future. He says, however, that should he decide to go south again he would travel towards the pole from Weddell Sea or Kaiser Wilhelm II Land.

The Size and Mean Height of Antarctica. Professor W. Meinardus has a paper in the November and December numbers of *Petermanns Mitteilungen* in which he discusses the distribution of atmospheric pressure and the consequent exchange of air between the northern and southern hemispheres and attempts to deduce from these data an approximate idea of the mean height of the southern continent. The tentative conclusions he reaches are that, having regard to the proportion of the Antarctic area known to be covered by sea, the land surface may be taken as 14,000,000 square kilometers and its mean height at 2,000 meters with a probable error, one way or the other, of 200 meters.

Commenting upon Dr. Meinardus's deductions, *Nature* says that the values he gives for the size and mean height of Antarctica may not be very far from the truth. Recent explorations, at least, suggest that these values are worth keeping in view. If the estimate as to size is approximately correct, Antarctica is one and a half times as large as Europe. It is also the highest of the continents, the mean height of Asia (950 meters) being less than half that of Antarctica as calculated by Prof. Meinardus. The enormously thick covering of inland ice is, of course, an important factor.

PHYSICAL GEOGRAPHY

An Atlantic Deep Sea Expedition. The London *Times* (Weekly Edition, Nov. 12, 1909), says that the Norwegian government has donated the use of its steamer *Michael Sars,* for a scientific expedition in the Atlantic from the Canary Islands to the Faröes. The vessel will be engaged in this work for four months. Sir John Murray, Dr. Johan Hjort of the Department of Fisheries, Norway, and Dr. Helland-Hansen, the Norwegian oceanographer, will take part in the expedition. The purpose is to try in the ocean the new methods and instruments that have come into use in the past few years. It is believed, for example, that very large fishing nets and trawls may now be used successfully at great depths—even down to three and a half miles. The *Michael Sars* has recently brought up from a depth of over a half mile, 225 fish, 100 of them belonging to new species. If these largest catching appliances can be used with success in the greatest depths of the Atlantic, important zoological results may be obtained. Special attention will be given to the distribution in depth of the pelagic algæ and their relation to the depth to which sunlight penetrates in different latitudes. Much interest will be attached to observations with Ekman's new current meter, which will be used to measure the rate of currents over oceanic shoals. The *Michael Sars* will leave Plymouth about April 6. A series of sections will be made from the coasts of Europe over the Continental Slope into deep water as far south as Gibraltar or beyond. It may be possible to make records, by this instrument, in very deep water, where our present knowledge of currents is almost nothing. Attempts will be made to force long tubes into the sea floor at oceanic depths with a view of procuring sections and ascertaining if there be layers differing in composition.

The Messina Earthquake. The Italian earthquake of Dec. 28, 1908, was of such interest to the people of earthquake-shaken Japan that they sent their great seismologist, Dr. F. Omori, at once to study the phenomena. He arrived in the district about the middle of February, remaining till the end of April. He studied the seismological phenomena while his colleague, Prof. F. Nakamura, studied architectural questions. At the end of a year his preliminary reports was written, published in English, and delivered in America. ("Preliminary Report on the Messina-Reggio Earthquake of Dec. 28, 1908," by F. Omori, *Bulletin* of the Imperial Earthquake Investigation Committee, Vol. III, No. 2, November, 1909, pp. 37-45.)

Dr. Omori shows that the Tokyo seismograph records indicated that a great shock (three times larger than the 1905 earthquake in Calabria) had originated in or near Calabria with large casualty, the time of origin being closely known.

In the field he found that the earthquake motion was sensible within an area of radius of 200 kilometers, buildings being damaged or destroyed throughout

an elliptical area thirty kilometers by twenty, containing the cities of Messina and Reggio, with a population of 190,000 people.

Almost all the houses in Messina were cracked or absolutely demolished. The city streets, usually less than 11 meters wide and with four to six-story buildings, were completely blocked with stones and mud, whose average depth was 5 meters. Consequently, a small proportion of those who escaped out of doors saved themselves. A little over 100,000 souls perished. The seismic intensity in Messina was a little less than that of Nagoya, Japan, during the great Mino-Owari earthquake of 1891, yet the loss of life compares in such ratio that Dr. Omori regards 998 out of every thousand persons in Messina who died as having been the victims of the bad construction of houses.

It is shown that the earthquake was not volcanic, but "caused by the sudden formation or extension of a crack within the earth's crust in a E. S. E. and W. N. W. direction, whose plane was nearly vertical or inclined slightly towards N. N. E."

The *tsunami* or *maremoto,* often erroneously called tidal waves, was observed for 38 kilometers on the Calabrian coast and 100 kilometers on the coast of Sicily, doing much damage to houses, bridges, breakwaters, etc., and rising to heights of from .8 to 10.6 meters. The tsunami moved northward through the Straits of Messina and seems to have been due chiefly to the settling of the loose surficial deposits through a height of 1 or 2 meters.

One of the maps shows clearly the relations of the area of violent motion to the similar areas for the twelve other great destructive shocks of Calabria since 1638, illustrating very clearly "the principle that great earthquakes in a given region occur, not everywhere at random, but along a definite line of weakness in the earth's crust, namely, a seismic zone. Further, the areas of violent motion of the different earthquakes are almost perfectly exclusive of each other, whence it may be concluded that the great disturbances are not repeated from one and the same center, but happen successively from different points or portions along the seismic zone. In other words, the places seismically most dangerous in Central and Southern Italy are exactly those points along the seismic zone here defined which have not yet been visited by a very violent shock. The two cities of Messina and Reggio-Calabria, which formerly had not been shaken by a great telluric convulsion originating from a center close by, had evidently their turn on the present occasion, and for that very reason may be supposed as being free from the danger of a future seismic catastrophe. Even in the case of a great earthquake occurring along the seismic zone, the intensity of motion at these two cities would, on account of the distance from the center, not be so very strong, and precaution taken in the construction of houses would be sufficient to prevent the loss of life and property."

L. M.

OBITUARY

Darius Ogden Mills. Mr. Mills died on his estate near San Francisco on January 3, 1910. He was born at North Salem, N. Y., in 1825. His distinguished career as a financier and publicist has, for many years, made his name well known to his fellow-countrymen. Mr. Mills became a Fellow of the American Geographical Society in 1880, a member of the Council in 1882 and Vice-President of the Society in 1901, which position he held until his death.

At a meeting of the Council on Jan. 20, 1910, the following minute was read by President Huntington and adopted by the Council:

"The members of the Society and of the Council mourn the loss of a man truly gifted with greatness of spirit whose life in all his relations with his fellowmen bore witness to the influence and power of integrity. He, many years, maintained the character of truth which his greatness and his simplicity entitled him to wear as a garment before men.

"We all grieve for the loss of one who touched profoundly our sense of the nobility of perfect honesty, sincerity, manhood and dignity."

William Henry Helme Moore. Mr. Moore died at his residence in New York City, on January 4, 1910, in his 86th year. For 47 years he had been identified with the American Geographical Society and was one of its most esteemed and prominent members. Following is an extract from a minute read by Vice-President Anton A. Raven, at the meeting of the Council on Jan. 20, 1910, and adopted by the Council:

"Mr. Moore entered Union College and was graduated from that institution in 1844. Later, he received the degree of LL.D. from his Alma Mater. His connection with this Society began as a Fellow in 1863. In 1870, he was elected Domestic Corresponding Secretary and he became Vice-President in 1897. Advancing years made it necessary for him to retire from the Council in 1906 but his interest in the Society was undiminished.

"Mr. Moore was a man of high ideals, courteous and sympathetic in his demeanor and had the respect and esteem of all with whom he was brought in contact. It is a pleasurable duty to bear testimony to his worth. We mourn his loss and tender to his family our warm sympathy in their bereavement."

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

The Story of the Great Lakes. By Edward Channing and Marion Florence Lansing. ix and 398 pp., Maps and Illustrations. The Macmillan Company, New York, 1909. $1.50.

This account is divided into three parts, each covering a stage in the development of the country about the Great Lakes. Part I contains the story of the discovery and exploration of the lakes. It is a story that fascinates the reader because of the wonderful men who penetrated into these Indian strongholds. There is the story of Champlain's trip to the Huron villages and his unsuccessful attempt to aid this Indian tribe in warfare against its Iroquois enemy. There arises in one a reverence for Father Jean Brebeuf, founder of the Jesuit Mission among the Hurons; and the account of the careful and well-conducted life the priests led among the savages and of their martyrdom when finally the Huron nation was destroyed by the Iroquois reads like a romance. Then follow in quick succession, the story of the pageant of Saint Lusson, agent of Louis XIV at Sault Ste. Marie, with regalia and ceremony intended to impress the savage guests, the history of the voyage of La Salle in his wonderful ship, the *Griffon,* and a description of the weak and unfortunate attempt of La Barre to frighten the chief of the Iroquois.

Part II is the story of the occupation and the contest for the possession of the Lake country. The account opens with the voyage of Cadillac and the founding of Detroit and this is followed by the history of the battle of Niagara and the gaining of Canada by the English. The attempt of Pontiac to conquer Detroit by conspiracy and his subsequent defeat and Wayne's campaign against the Indians are rehearsed, and the narrative continues through the war of 1812 to the completion of the Black Hawk war, when the foundations of the Lake states were laid.

Part III is entitled "Occupation and Development." The transformation of the old Iroquois trail from Albany to Lake Erie through the various stages of pathway, turnpike to railroad and canal lines is told in an attractive way. The impressions and adventures of early travellers are portrayed to make the story vivid. A chapter on "Lincoln and Douglas in Chicago" is introduced here to show, seemingly, how just prior to the Civil War, a lake state, Illinois, had become a "political storm centre to which the eyes of the whole people were turned," but the account breaks the continuity of the story and diverts the interest from the theme. On the industrial side, a description of three great industries, the fur trade, lumbering and copper mining, and the story of the shipping on the Lakes are given, but the space allotted to these is so limited that only the merest skeleton of facts is possible and the chapters merely suggest the extent of the development that has been made. The book is illustrated with a few pictures,

mostly from old prints, and contains a bibliography. It may be highly recommended as a background for the study of this region. The salient points of the story of the Lakes are emphasized, but "no minute and exhaustive chronicle has been attempted." ROBERT MARSHALL BROWN.

England and the English from an American Point of View. By Price Collier. 434 pp. Charles Scribner's Sons, New York, 1909. $1.50.

Mr. Collier has a style which pleases; it is what one may call very readable, though his writing at times has a vivacity which sets the reader questioning whether the plain facts of the case are not over seasoned with mere style. He has, as it appears, lived with the English, has seen and studied them when they have been on guard and off guard. He has the fashion of writing with a convincing air, and if you yourself have seen the English in their island home and have received impressions which you could not well classify and arrange, you will be helped by Mr. Collier's lucid analysis.

His "First Impressions" are, indeed, strikingly presented; but, perhaps, like most writers who undertake the portrayal of the manners and customs—all that, indeed, goes to make up the life of a people other than the writer's own—he sees much that goes to make up what we call national traits with eyes and judgment too serious. He is not one of them, and is often looking "at them rather than with them."

As a "Land of Compromises," Mr. Collier finds here much to criticise in state, church and social life; but he admits that "it is difficult with such people to discover what are their ideals, what are their real likes and dislikes."

Though writing a chapter on the topic "Are the English dull," he answers this, as a question, with an emphatic negative, and he takes occasion to praise what he calls their "steadiness," which many are inclined to interpret as dullness. The author is one who has been trained to see far more than the average person can or does see of the environment in which he may be placed. He is alert both to see, to hear, and to form judgments. There is an excellent chapter on "Sport," as there is an illuminating one on "An English Country Town."

E. L. STEVENSON.

The Lombard Communes. A History of the Republics of Northern Italy. By W. F. Butler. 495 pp., Illustrations, Maps, and Index. Imported by Charles Scribner's Sons, 1906. $3.75.

It is not an easy task to find one's way through the period of Italian history here under consideration. There were great general movements in those centuries which one can well and truly call peninsular or Italian, but there was so much of local coloring, so much that was strikingly individual in the social and political life of the many city-states, especially of central and northern Italy, that very clear and logical thinking and planning is essential for the one who successfully tells the story of the period. Professor Butler has done his work remarkably well. He has read his Muratori, Lanzani, Ferrari and others with care, though not always agreeing with the conclusions of the last two named. To the theory by these advanced,—a theory very generally accepted,—that the internal feuds of the Italian cities of the period were the results of an antagonism between the civic nobility, who had imbibed Roman ideas, and the country nobility, forced to come and live within the walls of the cities, Professor Butler

takes exception, and for the reason, as he asserts, that it would be practically impossible to find an instance in which the party faction clearly represents the original civic aristocracy and the other the conquered country nobles.

After telling us what Lombardy is, and briefly describing its geographical features, with special reference to the location of the several cities which dot this great northern plain, he then explains those movements by which the Bishops began to acquire temporal authority, a clear understanding of which is so essential in tracing the rise of republican institutions in Lombardy. In the opinion of the reviewer the beginnings of the free republics of this region are nowhere more clearly and concisely set forth than in the first four or five chapters of this work.

The Lombard League, in its struggles with the Emperor Frederick, claims at least six chapters, or near one-half of the book. Through a consideration of the party strifes of Guelf and Ghibeline which follow the wars of the League, we have it clearly set forth, without too much detail, how the despots at length appeared upon the scene as real liberators, who temporarily, at least, rescued the land from the destructive violence of party strife. We have, indeed, in this work a scholarly and readable account of the later mediæval centuries of northern Italian history, through which we pass directly into the important period of the Renaissance.

The illustrations of the work are excellent, directing attention in the main to the architecture of the period. The well-drawn maps are intended to represent territorial boundaries, within the region under consideration, at intervals of about thirty years from the beginning of the thirteenth century to the middle of the fourteenth.

E. L. STEVENSON.

Le Morvan. Étude de Géographie humaine. Par le capitaine J. Levainville, Docteur de l'Université de Bordeaux. 305 pp., 44 figures et cartes, 40 phototypics et 4 dessins hors texte. Armand Colin, Paris, 1909. Fr. 10.

The features which make a geographical unit of the Morvan "country" are mainly negative; it is the country deprived of all that makes the neighboring countries attractive. While it has never formed a political or ecclesiastical province—a circumstance which it has in common with several of the most important "countries" of France,—its location and extent are determined by a consensus of popular opinion which, all over the adjoining countries of Nivernais and Burgundy, designates the hilly solitudes which separate the latter as the "bad country" in opposition to their own prosperity and possibilities. War has never penetrated into these hills, where no booty of any value would reward the victor; nor, on the other hand, has the progress of modern thought and civilisation. Its only connection with the fate of the larger country was made through the soldiers which it furnished to the armies of the King, and the wood that was shipped from the forests to heat the people's homes. Geologically, Morvan is one of the "old" countries of France; it belongs to the belt of crystalline rocks which traverses France from Brittany to the Vosges, and its boundaries correspond on the West, North, and East, to the line of contact—often enhanced by faults—between these "primary" rocks (*e. g.*, Archæan to Permian) and the sedimentary rocks of "secondary" origin; toward the South the line of demarcation is less distinct. A border zone of liassic remnants adjoins the Morvan proper on the North and East; the lower northern half (Bas Morvan), is an old dissected peneplain in process of rejuvenation, while the southern and

highest part (Haut Morvan) was formed contemporaneously—and, perhaps, in connection—with the chains of the Alps.

These natural differences are reflected in the economic aspects and conditions of the respective regions. The liassic limestones of the border zone make comparatively good soil, which is productive of meadows and fields; the settlements, obliged to cluster around the wells and springs, form large villages, and the limestone used in the construction of the houses gives the landscape an aspect of gaiety which is not found elsewhere in the country. Buttes and mesas of hard limestone introduce a picturesque element into the scenery and betray, at the same time, the existence of a former peneplain worn down almost to base level. In the Bas Morvan, too, the present topography is the work of erosion. Its rocks are mainly gneisses and granites, and the width of the valleys and the heights of the hills are in proportion to the greater or lesser resistance of the rock material. Seen as a whole, the surface is gently undulating; in the gneiss districts the valleys are broader and the humps more numerous; the valleys are well drained and the waste of the hills has made comparatively good soil in the bottoms (*ouches* in the vernacular). The granite rocks make steeper slopes often strewn with large boulders. The water often stagnates in the bottoms; hence ponds are frequently found there and the fields are poor; the slopes make pastures, and woods of crippled oaks cover the hilltops. The population, finding water all over the country, is under no compulsion to crowd around any special place for its sake; on the contrary, the poor soil necessitates larger farms, and the utilisation of every square foot of tolerable quality. Hence the settlements are scattered all over the country, and the distances between the cheerless, low, grey, thatched houses increase as the quality of the soil decreases.

The Haut Morvan is composed mainly of eruptive rocks of carboniferous origin, and of Devonian schists and quartzites. Under the combined action of Tertiary uplift and of erosion its topography has become quite diversified. Its principal characteristics are the numerous valleys or basins of an almost square shape which owe their origin and form to the two diametrically opposite directions of the Alpine uplift. Their bottoms are occupied by the settlements, while the hills are covered with pastures, heaths, and woods.

The climate of Morvan is rougher than it ought to be by virtue of its geographical location, because the chilling effects of altitude are reinforced by the excess of moisture on the impervious soils. Woods and forests predominate, therefore, and in many "cantons" they are to-day as untouched as they were in Roman times. There are 75 acres of woodland per inhabitant in this country, against 25 acres per inhabitant for the whole of France. In the past the export of wood for fuel, especially to Paris, used to be its chief means of sustenance; but since the introduction of coal and kerosene for fuel, this modest industry has experienced a heavy drawback which is especially hard for the small landowners who can, or will, not combine to control the prices. Necessity has obliged the people to try their soils for agricultural purposes, and by means of fertilisation and a scientific rotation of the crops, as good results have been obtained as may ever be expected of a "bad" country.

More satisfactory have been the experiments at utilizing the land for pastures. Horses, cattle, and pigs have proved good sources of income to their breeders. The lack of good roads is, however, even now a great obstacle to real progress, for, owing to the bad connection with outside centers, most of the trading is still done at local markets where oversupply keeps the prices down.

A new, and very profitable, industry has been introduced since 1842, namely, that of nursing. Almost every wet-nurse in Paris is a native of Morvan. This business has reacted, however, as a check on the natural increase of the otherwise very prolific, population, through the increase of infant mortality among the nurses' own children. On the other hand, it is about to establish an interesting exchange of city and country population. According to the custom of French urbanites to have their children brought up at the nurses' homes in the country, many of these women take their wards to their native villages, and having once grown up there, quite a number of the latter remain and settle in the country. This influx seems so important that fears have already been expressed lest the native race, hitherto exceptionally pure in its isolation, be altered, in a future not very distant, through the assimilation of so much foreign blood. As far as numbers go, this increase is more than compensated for by the number of those nurses who become acclimated in the city and cause their families to follow them. Besides these permanent migrations, there are temporary exodi of the Morvanders as season laborers in the adjoining countries, whose dates for the performance of the various stages of farm work are considerably in advance of the mountains. Thus, the Morvander often goes through a regular cycle of labor, rising and descending as the season requires: in Jan. and Feb. he is a woodcutter at 600 m. above sea level; from the end of Feb. to the beginning of April, he floats or rafts wood at 350 m.; from the latter part of April to the middle of June, he labors in the fields at or below 200 m.; then he rises again to 450 m. to take care of his own fields until the beginning of July; from then to the middle of August is harvest time at 200 m.; from then to the middle of Sept. the same in Morvan; from then to the middle of October, vintage in Burgundy; from then on to the end of the year, fall sowing and general work about the farm on his own ground. The money earned abroad, by the laborer as well as the nurse, is invested in improving their homes and their standards of life both of which are sorely in need of it, owing to the combined power of poverty and ignorance.

As another of the series of French monographs published by Armand Colin, the book is worthy of its predecessors, both with regard to what it teaches the reader about its subject, and the pains taken by the publishers in making type, pictures, and maps, as excellent as possible. MARTHA KRUG GENTHE.

Mythen und Erzählungen der Küstenbewohner der Gazelle Halbinsel (Neu-Pommern) im Urtext aufgezeichnet und ins deutsche übertragen von P. Jos. Meier, M.S.C. xii and 291 pp. Druck und Verlag der Aschendroffschen Buchhandlung. (Anthropos-Bibliothek, Band I, Heft 1.) Münster i. Wien, 1909.

To those whose geography of the western Pacific has been practical, the memory needs no long flight to recall a period when New Britain was almost wholly unknown. Twenty-five years ago, the adventurous voyager who pushed up St. George's Channel beyond the Duke of York group was sailing quite into the uncharted seas, unknown lands and wild races of men. Such fragments of information as were available were to be found only by diligent search of the geographical journals, and even in the case of so earnest an explorer as Wilfred Powell, were found to apply but poorly to the terrain itself.

Now New Britain is coming into knowledge. Germany has annexed the islands in that sea, and has given to the archipelago and to all its islands new and German names. Hence in the title of Father Meier's book we find Neu-

Pommern. Within a year we have reviewed Stephan and Graebner's work on the opposite coast of New Ireland, one of the best geographical monographs, and the highly important work of Parkinson, "Dreissig Jahre in der Südsee," most of which deals with the Gazelle Peninsula; and now comes Father Meier with an inner record of the people.

Of the inhabitants of the peninsula we already begin to have a certain degree of accurate information. In their ethnic bearing, they are to be classed among the Melanesians. We know at least that the people of the Gazelle Peninsula are widely removed from the Papuans of New Guinea and that their affinities are traceable for a considerable distance down the range of the Solomon Islands and perhaps even further into the northern New Hebrides. Equally with their southern congeners they have been affected by the sweep of Polynesian migration past their coast, and in the quality of the loan material absorbed into their cruder speech, we find them above many of the southern Melanesians.

Father Meier has collected the inner life of the people in this collection of their tales. He finds them gay, not disposed to find much to dread in life. He explains the origin of the first men, a pair of men and one a fool, as a moon myth representing the full and the dark of the moon. He gives their record of the creation of the first pair. Who created them? They were scratched in outline on the ground, the figures were sprinkled with blood and covered with leaves. Then they became men and themselves created women out of cocoanuts. But who scratched the figures, whose blood was shed to give them life? Why, He. What could be a simpler statement of first cause? Absolutely naught more is known by these people than in these opening words of their saga of the making of man: "He scratched two male figures on the soil, he scraped his skin and as the blood trickled down he sprinkled it on the two figures."

In other stories we have an interesting history of the two men of this first creation, To Kabinana and To Karvuvu. The latter is the fool, and he it is who brings to mortals their mortality.

There is a large collection of beliefs of the life among the shades, very interesting in the fearlessness with which the natural man passes out of life. We find also a mythology of the beasts and birds, stories bubbling over with good humor and rich enjoyment of natural life. Unmoral as all these stories are we note with no surprise that they are all clean; the tellers of these tales are still too low in the scale of thought to have reached the point where indecency becomes a topic for literary expression.

Adding this work to the scanty collection of material upon this region, it is to be hoped that Father Meier will present still more contributions from the store of his intimate acquaintance with the people to whom he has devoted his life.

WILLIAM CHURCHILL.

Report on the Scientific Results of the Voyage of S. Y. "Scotia" during 1902, 1903 and 1904. Under the Leadership of William S. Bruce. Vol. II. Physics. Part 1. Meteorology, by R. C. Mossman; Part 2.—Magnetism, by Charles Chree and R. C. Mossman; Part 3.—Tides by Sir George H. Darwin. v and 324 pp., Maps, Diagrams, and Illustrations. 1907. 1 Guinea.

Vol. IV. Zoology. Part 1.—Zoological Log, by David W. Wilton, J. H. Harvey Prie, and R. N. Rudmose Brown. xiv and 103 pp., 2 Maps, 33

Plates, including 100 Photographs, Colored Frontispiece, and Index. 1908. 10s. 6d.

Vol. V. Zoology. Parts 1-13.—Invertebrates, by Prof. J. A. Thomson, J. Ritchie, Sir Charles Eliot, James Murray, and others. viii and 313 pp., and 36 Plates. 1909. 23s. 6d. The Scottish Oceanographical Laboratory, Edinburgh.

The scientific results of the *Scotia* Antarctic Expedition, 1902-4, commanded by Dr. William S. Bruce, were of the highest value, and the scientific workers who are especially interested in one or another of these reports are glad to see that they are being produced in a series of fine volumes worthy of their importance.

The first of them to appear in book form is the first three Parts of Vol. 2 containing the meteorological, magnetic and tidal results of the expedition. Most of the volume is devoted to the meteorological results, and, as the expedition was particularly strong in meteorology, with Mr. Robert C. Mossman in charge of the department, this feature of the work has special value. The tables, meteorological log and discussion of the results occupy 306 pp., and the report gives full details of the various phases treated. Mr. Mossman contributes a number of pages of notes on the magnetic observations which are discussed by Dr. Charles Chree, who has testified to the excellence of Mr. Mossman's work in this department, though the expedition had not been fitted out to carry on magnetic researches. The tidal results are discussed by Prof. G. H. Darwin, who speaks of them as very valuable as relating to a very great expanse of sea uninterrupted by land.

Vol. IV, Part 1, gives the Zoological Log of the expedition and it illustrates the value of the practice, upon which Dr. Bruce insisted, on this expedition, of making immediate records of everything of scientific value. The log is a field notebook of the natural history of the voyage, a faithful record of the life observed, and helps to fill in the picture of the Antarctic regions.

Zoology is treated in Vol. 5, which is devoted to the Invertebrates. The various collections were placed in the hands of specialists and the scientists of France, England, Germany and Ireland collaborated with those of Scotland in the production of this handsome volume. Most of the papers relate to new species and other matters that have comparatively little geographical interest. Dr. Koehler of Lyons, in his paper on the Echinoderms (except the Holothurians) emphasizes the great value of the results of the *Scotia* expedition from the point of view of deep-sea work. "The naturalists of the *Scotia* were the first to do deep-sea dredging in high southern latitudes and the results show how much there is still to be done in the working out of the fauna of these seas."

The volumes, which are edited by Dr. Bruce, have many illustrations and a number of maps. A fine series of plates in Vol. IV is given to the many phases of animal life that were observed in the Antarctic.

A Junior Course of Comparative Geography. New Edition. By P. H. l'Estrange. viii and 384 pp., 142 pp. of Maps, and 146 Pictures and Diagrams. George Philip & Son, Ltd., London, No date. 3s. 6d.

The new edition appears in much enlarged form, but the general plan and the order of chapters are unchanged.

It is a volume for children in the upper grammar grades, as we would say,

dealing with the principles of physical geography and with the general geography of the several continents. The elements of physical geography are first organized and text, illustrations and maps are then applied, first to the interpretation of the British Isles, then to Europe, North America and Asia, to Central and South America and Africa, and finally to the British Empire. By this plan continents which have many similarities are treated together, so that comparisons are readily possible, and the home country is studied first and last, thereby giving the pupils a better understanding of their own empire than they have of any other part of the world.

The black and white physical, political and economic maps are the most prominent feature of the book and give a basis for the excellent map questions and exercises with which the volume is liberally provided. The method of procedure is excellent and good results ought to be secured by any well-equipped teacher who uses the plan intelligently. The text is in some cases meagre and does not fully supplement the map questions. For American teachers the book is suggestive for its plan and its exercises, many of which could be readily adapted to the study of the more attractive and clear maps in our school texts.

R. E. Dodge.

Madeira: Old and New. By W. H. Koebel. xi and 216 pp., many Illustrations from Photographs by Miss M. Cossart, and Maps. Francis Griffiths, London, 1909. 10s. 6d.

An interesting though somewhat discursive account of a fascinating country. The earlier portion of the volume deals with the history of Madeira, which helps us to understand some of the persistent habits and customs of the people as well as their mental point of view. The later and larger portion of the volume deals with the present conditions in Madeira, with especial emphasis of the scenery, methods of transportation, religious fiestas, the industries and the development of Madeira as a tourist resort. One chapter is devoted particularly to hints for tourists.

The history of the alternation of wine and sugar as the leading agricultural crops of the country, is considered in some detail with the reasons therefor. Three times in the last century, the vine has been cultivated, and the climate and soil seem to make it the natural crop of the region. The description of the irrigation and water supply system as now seen in the ever-present "levadas" is very interesting, as showing how early some of the modern systems of water carriage were developed in spite of engineering difficulties and the lack of engineering skill.

The chapter on the climate gives the impression that Madeira is a winter paradise more attractive than the Riviera. The average annual range of temperature is only 6°, but in the winter months the higher portions of the islands are very frequently cloud-covered and depressing. The warm, dust-bringing, easterly wind, known as the "leste," is a striking feature, and its disastrous effects on the vegetation and on animal life are very great. In spite of these periodic invasions of dust, Madeira is in general dustless and clear.

The book reads well, the illustrations are numerous and good, but poorly placed in the text. The volume as a whole is a popular tale, told from a good knowledge of facts of geography, history and present life. The story is well told, but would have been more effectively presented if a more adequate map had been included.

R. E. Dodge.

Au pays de l'or noir. Para, Amazonas, Matto Grosso. Par Paul Walle. 244 pp., 60 Views from Photographs and 3 Maps. E. Guilmoto, Paris. No date. Frs. 4.50.

An interesting and complete account of the rubber industry in the valley of the Amazon, including the areas of production, the types of rubber forming trees, the methods of gathering and treating the gum and the statistics of rubber trade in the region.

The earlier part of the volume includes a description of the geography of Pará, a glowing account of the climate of the Amazon region, grazing in the Amazon country and an account of a voyage up the Amazon, including descriptions of the cities and towns which may be seen from the steamer. The remaining seven chapters are devoted entirely to the rubber industry.

One is struck by the author's emphasis of the healthfulness of the Amazonian climate, which seems to be borne out by the comparative statistics of mortality. These show that the death rate here is 28.75 per thousand, which is less than half that at Bombay and slightly less than that at St. Petersburg.

Grazing in the natural grassy areas and in fenced farms is developing rapidly and herds of cattle, zebus and horses are numerous and increasing. In some cases modern systems of breeding are being introduced and the milk-producing ability of the cattle is being rapidly increased. The industry seems to thrive in spite of the alligators and jaguars, and the cattle diseases which at times produce enormous destruction.

In the chapters on rubber production, the character and value of the different rubber-producing trees are considered in detail and the palm given to the "King of all rubber trees," the *Hevea braziliensis*. Brazil to-day produces more than 65 per cent. of the rubber of the world, and vast areas of rubber culture are as yet unexploited. Particularly interesting is the account of the development of Acre which, only a few years ago, was in the public eye because of the attempts to make this region an independent country. Brazil secured this country by treaty and by paying an indemnity of £2,000,000 sterling. Already this region has been of great value to Brazil and has more than paid for itself from the profits of its rubber.

The author devotes one chapter to a comparison of the value of Amazonian rubber with Asiatic rubber and shows that the former is generally considered by the rubber brokers as more elastic and strong. This is largely due, it is supposed, to differences in the method of rough curing of the rubber, and the author believes that the difference in production in Brazil's favor is to increase as the years go on.

The volume is well written and well illustrated and gives an excellent account of the rubber industry in the Amazon country up to the end of the year 1908. It forms an excellent source of information and is a distinct, authoritative addition to our rational volumes on commercial geography. R. E. Dodge.

The Geology and Scenery of the Grampians and the Valley of Strathmore. By Peter Macnair. Two Vols. Vol. I, xiv and 195 pp.; Vol. II, xii and 199 pp.; Bibliography, Index and many Photographs, Diagrams and Maps. James MacLehose & Sons, Glasgow, 1908.

The geological history of the Grampian Hills of Scotland and the Midland Valley or "Lowlands" south of them, as set forth in this two-volume work, may

be summarized as follows: A series of Pre-Cambrian (?) rocks, mostly marine sediments, was raised above the sea and folded into several great "fans" whose axes trended northeast and southwest. Marine erosion reduced this mountain system to a submarine plain, upon which red marine sediments, the Old Red Sandstone system, were deposited. The whole was then apparently raised above the sea. One of the great denuded fan-folds, with the sandstones lying upon its bevelled surface, was dropped down between two fault planes, and now underlies the broad Midland Valley. In the district of the Grampians, north of the valley, southeast flowing streams developed on the southeast sloping surface of the Old Red Sandstones, and finally cut into the underlying Pre-Cambrian (?) rocks, whereupon northeast-southwest tributary streams were developed along soft rock belts trending with the strike of the fan folds. Ultimately subærial erosion removed the sandstones from most of the highland area, exposing the old surface of marine denudation, now much dissected by the transverse and longitudinal streams. Glaciation deepened some of the stream valleys to form lake basins, and filled others with glacial deposits. Slight changes in the position of the land with respect to sea level, and the normal work of post-glacial river erosion have given the finishing touches to the landscape.

The reader will unfortunately find much in the work which merits unfavorable criticism. The evidence presented in the text does not convince one that the author's interpretation of structure is correct. The verity of the marine planation of the ancient rocks rests on the assertion that the conglomerates at the base of the Old Red Sandstone series point unmistakably to the existence of a sea margin creeping slowly inward upon the gradually sinking land. The possibility of a relatively recent date and subærial origin for the base-levelled plain is not considered by the author; and the highly improbable interpretation of it as a resurrected marine plain of ancient date is not supported by any evidence. The marine origin of the Old Red Sandstone series is defended, in spite of its included remains of land plants and fresh-water fishes; and the arguments by which the author supports the marine theory take no account of the literature on continental deposition which has appeared in the last decade.

The work is full of obscurities and contradictions. The volcanic rocks occurring in the Old Red Sandstone are described on page 5 of Volume II as having been poured out on the sea-floor and interbedded with the sandstones; on page 159 of the same volume we read that after the sandstones had been deposited, uplifted, and later dropped down between two faults, the sunken area became the site of igneous action which poured the lavas out on the surface and intruded sills and bosses into the strata. It would appear that the same volcanic rocks are referred to in each case. The diagram on page 160, Volume II, to illustrate one stage in the geological history of the region, shows a base-levelled surface which is not mentioned in any place in the two volumes.

The physiography and scenery receive less attention than the structure and stratigraphy, and the treatment of the former two topics is perhaps even less satisfactory than that of the latter. Much space is devoted to lists of altitudes of numerous peaks, to the location of things better shown on maps, and even to the enumeration of the tributaries entering the two sides of rivers. Important matters, such as the present appearance of the dissected base-level plain, the development of the drainage features, and the glaciation of the highland valleys, receive treatment which is quite inadequate, and in many places even crude.

The descriptions of the base-level surface are not supported by the illustrations, which suggest an upland of marked relief. Lake basins are accepted as the measure of glacial erosion, notwithstanding that the error of this measure has often been pointed out. The importance of ice action in modifying the forms of the valleys and in producing much of the ruggedness of mountain form, is not recognized. It is asserted that the Highland valleys were formerly filled up with boulder clay, which was later removed by local glaciers and post-glacial denudation; yet no evidence is given to support the assertion of so improbable a history.

The work is abundantly illustrated by numerous beautifully colored maps and excellent engravings. Occasionally the confusion which characterizes much of the text is apparent in the maps. On the geological map at the end of Volume I, the axis of the great central fan or "Fächer" is located near the northern boundary fault of the Midland Valley, and labelled "Supposed axis of Marginal Fächer." The axis of the "Ben Lawers Fächer" is labelled "Axis of Great Central Fächer." As a result, the descriptions on pages 181-183, with their reference to the map, are most confusing.

The work is altogether a most disappointing publication. The reader finishes his perusal of the text with the conviction that it does not treat in a capable and convincing manner the important subject with which it deals.

D. W. Johnson.

The California Earthquake of April 18, 1906. Report of the State Earthquake Investigation Commission. In Two Parts and Atlas. By Andrew C. Lawson and Others. Part I: xviii and 254 pp.; Part II: pp. 255-451, Maps, Seismograms, and Illustrations. Carnegie Institution of Washington, Washington, 1908. Price (2 Parts and Atlas) $17.

The Atlas is noticed in the *Bulletin,* Vol. 41, p. 469. The Report has been everywhere recognized not only as an able and complete account of the California earthquake of 1906, but also as a very important addition to the literature of seismology. Although the Commission which made this investigation and report was appointed by the Governor of California, the State government provided no funds for the conduct of the work. The resulting embarrassment was finally relieved by a subvention from the Carnegie Institution.

Wissenschaftliche Ergebnisse der Expedition Filchner nach China und Tibet, 1903-1905. X. Band—1. Tiel. 1 Abschnitt: Zoologische Sammlungen. C. Attems, M. Burr, A. Forel and Others; 2 Abschnitt. Botanische Sammlungen. Prof. Dr. Diels. xii and 288 pp., Map, Illustrations, and Index. Ernst Siegfried Mittler und Sohn, Berlin, 1908.

The expedition of Lieut. Wilhelm Filchner to China and Tibet was remarkably fruitful in scientific results and was recognized by the German Geographical Congress with a special vote of thanks. Means were provided for the full presentation and discussion of these results and the volumes are now appearing, in sumptuous form, from the press of Mittler & Son. Eighteen specialists of Germany, Austria, Switzerland and England report, in the present volume, on the zoological collections. The botanical results, chiefly the work of the explorer's wife, are discussed by Dr. Diels in 28 pp.

La Figure de la Terre. Les grandes opérations géodésiques. L'ancienne et la nouvelle mesure de l'arc méridien de Quito. Capitaine G. Perrier. (Revue de Géographie annuelle. Tome 11.-1908.) vi and 307 pp., Maps, Illustrations, and Tables. Librairie Ch. Delagrave, Paris, 1909.

Captain Perrier of the Service géographique de l'Armée of France, gives to geographers in this volume a comprehensive account of the measurement of arcs of the meridian in Peru, Ecuador, Sweden, Spitzbergen, the United States, Canada, South Africa and other parts of the world, and the results of these labors. The work covers the development of geodesy in the past three centuries and shows the necessity for these great geodetic operations in order to establish the bases for exact topographic mapping. The author describes in detail the methods of measuring an arc of the meridian and the modern instruments employed. The bibliography with 97 titles will be found very useful.

Die Schwerebestimmung an der Erdoberfläche. Prof. Dr. Joh. Bapt. Messerschmitt. viii and 158 pp., 25 Illustrations and Index. Friedrich Vieweg & Sohn, Braunschweig, 1908. Price, M. 5.

One of the best works yet written on Gravitation and Gravity Determinations. The author, who is in charge at the Magnetic Observatory at Munich, describes the principles upon which the determination of gravity depend, the methods and apparatus used in observations and the importance of the study in investigations relating to the figure of the earth. The book is No. 27 of the natural science and mathematical monographs published under the general title of "Die Wissenschaft" by Vieweg & Son.

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NEW MAPS

NORTH AMERICA

United States Geological Survey Maps

United States. Map Showing the Distribution of Iron Ores in the United States. 1 inch=110 miles. Prepared by E. C. Harder. Illustrates "The Production of Iron Ores, Pig Iron and Steel in 1908," in "Mineral Resources of the U. S., 1908," U. S. Geol. Surv., Washington, 1909. [Colors to distinguish hematite brown ore, magnetite and iron carbonate. List of districts, variety of ore and active mines are given on margin with numbers corresponding to those on the maps.].

United States. Map of the United States Showing Locations of Blast Furnaces in 1908. 1 inch=110 miles. Compiled by W. T. Thom. Based on Swank's Iron and Steel Works Directory for 1908. Illustrates "The Production of Iron Ores, Pig Iron and Steel in 1908" from "Advance Chapter from Mineral Resources of the U. S., 1908." U. S. Geol. Surv., Washington, 1909. [Locations of blast furnaces are shown in red, numbered for lists of districts, locations and number of stacks printed on margin.]

United States. The following Black and white maps illustrate *Bull* 381—A, "Investigations of Coal Fields in Indiana, North Dakota and Montana by the U. S. Geol. Surv. in 1908:" (a) Map of Washburn Lignite Field, N. D. 1 inch=4 miles. By Carl D. Smith. [Shows lignite mines and exposures with list of mines and composite section.] (b) Map of Fort Berthold Indian Reservation Lignite Field, N. D. 1 inch=4 miles. By Carl D. Smith. [Shows lignite outcrops and exposures.] (c) Map of Fort Peck Indian Reservation Lignite Field, Mont. 1 inch=4½ miles. By C. D. Smith, J. A. Davis, E. R. Hopkins and E. L. DeGolyer; (d) Map of southeastern part of Bull Mountain Coal Field, Mont. 1 inch=1 mile. By R. W. Richards. [Shows probable thickness of various beds, with columnar section.] (e) Map of northwestern part of Bull Mountain Coal Field, Mont. 1 inch=1mile. By R. W. Richards.. Detail as on map d; (f) Map of Milk River Coal Field, Mont. 1 inch=3 miles. [Shows rock formations, coal zones, mines and prospects with 23 columnar sections.] (g) Map of Northern Part of Custer National Forest, Mont. 1 inch=4 miles. By Carroll H. Wegemann. [Shows coal outcrops, mines, prospects and stratigraphic sections.]

FLORIDA. Geologic and Topographic Map of Florida. 1:1,000,000=15.78 miles to an inch. Prepared by the U. S. Geol. Surv. in Co-operation with the Florida Geol. Surv. Geology and Topography by G. C. Matson, F. G. Clapp and Samuel Sanford under the direction of T. Wayland Vaughan. With 2nd Annual Report, 1908-9, of the Florida State Geol. Surv. (in pocket), Tallahassee, 1909. [14 colored symbols for geological formations and a section across the peninsula in the latitude of Daytona and Ocala.]

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, Jan. and Feb., 1910.
Pilot Chart of the North Pacific Ocean, Feb., 1910.

U. S. WEATHER BUREAU CHARTS

Meteorological Chart of the North Atlantic Ocean, March, 1910.
Meteorological Chart of the South Atlantic Ocean, March, April, May, 1910.
Meteorological Chart of the North Pacific Ocean, March, 1910.
Meteorological Chart of the South Pacific Ocean, March, April, May, 1910.

DEPARTMENT OF AGRICULTURE MAPS

UNITED STATES. Soil Survey Maps of the Modesto-Turlock Area, Cal.; Bienville, East Carroll and West Carroll Parishes, La.; Montgomery Co., N. Y.; Richland Co., N. D.; Parkersburg Area, W. Va. 1:63,360 and 1:62,500. [Each map accompanied by descriptive text.]

NEW YORK. Economical Geology of New York and Part of the Adjoining States. No scale. By Amos Eaton. With paper "One Hundred Years of New York State Geologic Maps 1809-1909," by Henry Leighton. Museum *Bull.* 133, New York State Museum, Albany, 1909. [A reproduction of the first geologic map of New York State as a unit. It appeared in Eaton's "Text-book" in 1830.]

NEW YORK. Geologic Map of the Port Leyden Quadrangle. 1:62,500=1.9 mile to an inch. Illustrates *Bull.* 135, New York State Museum, Albany, January, 1910. [14 symbols for geological formations, distribution of stone quarries and three structure section lines across the quadrangle referring to figures on page 38, giving a general idea of the rock fomations and their relationships to one another.]

CALIFORNIA. (a). Map of a Portion of the Shasta Co. Copper Belt East of the Sacramento River....showing the principal Mining Properties. (b). Copper Belt of Northern Siskiyou Co.; (c) Green Mountain Group of Mining Claims, Mariposa Co.; (d) Map of the Ubehebe Mining District, Inyo Co.; (e) Map of Mining District in immediate Vicinity of Greenwater, Inyo Co. California State Mining Bureau, Lewis E. Aubury, State Minerologist, San Francisco, 1908. [Black sketch maps showing the copper mines in the areas mapped. Illustrates *Bull.* 50, "The Copper Resources of California."]

CALIFORNIA. Map of California Showing the Approximate Location of the principal Copper Deposits of the State. 1 inch=21 miles. With Bulletin No. 50, "The Copper Resources of California," California State Mining Bureau, Lewis E. Aubury, State Minerologist, 1908. [The copper locations are shown by red dots.]

CANADA. Carte de la Colonisation dans le Nord-Ouest canadien. 1:7,500,000=118.35 miles to an inch. With "Les Ressources naturelles du Nord et du Nord-Ouest canadien" in *Ann. de Géog.*, Vol. 18, Nov. 15, Armand Colin, Paris, 1909. [The detail of botanical limits, cultural features, etc., are finely reproduced on a smaller scale from maps in "Canada's Fertile Northland," the "Atlas of Canada," and the "Railway Map of the Dominion of Canada," published by the Dominion Government.]

CANADA. Topographical Map of Part of the Main Range of the Rocky Mountains adjacent to the Canadian Pacific Railway. 1:80,000=1.2 mile to an inch. From photographic surveys by Arthur O. Wheeler, assisted by M. P. Bridgland and H. G. Wheeler. Contour interval, 250 feet. Department of the Interior, Topographical Surveys Branch, Ottawa, 1903-7. [Illustrates "The Rockies of Canada," by Walter D. Wilcox. Black and white.]

CENTRAL AND SOUTH AMERICA

PERU. Croquis que Indica los Linderos Agrícolas y la Geologia de los Valles de Chicama y Santa Catalina. 1 inch=2 miles. With descriptive text. *Bol.* del Cuerpo de Ingenieros de Minas del Perú, No. 71, Lima, 1909. [Agricultural areas in green.]

PERU. Croquis del Valle de Jequetepeque ó Pacasmayo que Destaca el Area de Pampa y el de Valle Cultivados. 1 inch=2 miles. With descriptive text. *Bol.* del Cuerpo de Ingenieros de Minas del Perú, No. 71, Lima, 1909. [Agricultural areas in light, and valley of the Rio Jequetepeque in dark green.]

AFRICA

CENTRAL AND SOUTH AFRICA. 1:5,000,000=79 miles to an inch. 6° N.-36° S. Lat.; 8°-43° E. Long. By J. G. Bartholomew. Insets of East London, Port Elizabeth, Cape Town, Durban, Lourenço Marques and the Mouths of the Zambezi river. The Edinburgh Geographical Institute, Edinburgh, 1910. Paper, 2s, cloth, 3s. [A new edition of this excellent map giving railroad extensions and other new information. One of the most satisfactory maps of these parts of Africa.]

EAST AFRICA. Die Ostafrikanische Bruchstufe von 1° 40′ bis 4° südl. Breite. 1:150,000=2.38 miles to an inch. 2 Sheets. Bearbeitet von Carl Uhlig mit Unterstützung von Max Moisel. 35° 30′-36° 38′ E. Long. In *Mitt. aus den Deutsch. Schutzgeb,* Ergänzungsheft 2, Teil 1: Die Karte, Berlin, 1909. [This fine map gives the geographical results of the survey by Dr. Uhlig of a part of "The Great Rift Valley" of East Africa. His expedition spent 6½ months in 1904 in the survey and four chapters of this supplement are given to a discussion of the construction and contents of the map. It is in 3 colors: yellow for contours (interval about 100 feet), blue for hydrography and black for nomenclature. It was produced at the cartographic establishment of D. Reimer (E. Vohsen), Berlin. The map and the accompanying letterpress are particularly fine examples of geographical work. Dr. Uhlig has used on the map, not only his own results, but also those of other observers in the same field.]

SAHARA. Croquis du haut Guir. 1:1,000,000=15.78 miles to an inch. No map net. With "Le Haut Guir," By Général Bernard in *Bull.* Soc. de Géog. d'Alger et de l'Afrique du Nord, Vol. 14, No. 2, Algiers, 1909. [Sketch map

of the hitherto unknown region to the west of Colomb Béchar, drawn during the campaign of a French military force in 1908.]

SPANISH GUINEA. Itinéraires de la Mission Cottes à travers la Guinée Espagnole. 1:1,600,000=25.2 miles to an inch. With paper "La Guinée espagnole" in *Ann. de Géog.*, Vol. 18, Nov. 15, Armand Colin, Paris, 1909. [A black sketch map.]

UGANDA. Schema Geologico del Gruppo Centrale del Ruwenzori. 1:40,000=0.6 mile to an inch. By A. Roccati. Il Ruwenzori (Parte scientifica, Vol. 2). Ulrico Hoepli Milan, 1909. [Shows the geological results of the Duke of the Abruzzi's expedition, June-July, 1906, in the central group of Ruwenzori. Nine colors to show geological formations.]

UGANDA. Carta Geognostica della Zona dell'Uganda. 2,100,000=33.1 miles to an inch. Il Ruwenzori (Parte scientifica, Vol. 2). Ulrico Hoepli, Milan, 1909. [6 colors show the geological formations along the route of the Duke of Abruzzi's expedition from Entebbe, the British capital of Uganda, to the summit of the Ruwenzori range.]

ASIA

CELEBES. Schetskaart vas Tapalang. 1:100,000=1.5 mile to an inch. Illustrates paper "Medeelingen, Betreffende Eenige Mandharsche Landschappen." *Bijdragen* tot de Taal-, Land-en Volkenkunde van Nederlandsch-Indië, Vol. 7, Part 8, 1909. [A black and white map showing topography, footpaths, etc.]

FORMOSA. No scale. With "De Rietsuiker-industrie in de verschillende landen van productie. In *De Indische Mercuur,* Vol 33, No. 1 Amsterdam, 1910. [Black sketch map showing boundaries of perfectures, railroads, area in sugar and the mountain lands of the east.]

INDIA. Volksdichte im Nordwestlichen Indien. 1:3,000,000=47.34 miles to an inch. By H. Heins. With paper of same title and author in *Pet. Mitt.* Vol. 55, No. 7, Justus Perthes, Gotha, 1909. [Based on the Indian Census of 1901.]

TIBET. Dr. Erich Zugmayers Reiseweg in Nordwest-Tibet, Juni bis Sept., 1906. 1:1,000,000=15.78 miles to an inch. From his own surveys. With "Bericht über eine Reise in Westtibet," by Dr. Zugmayer. *Pet. Mitt.* Vol. 55, No. 7, Justus Perthes, Gotha, 1909.

AUSTRALASIA AND POLYNESIA

PONAPE. Karte der Insel Ponape. 1:100,000=1.5 mile to an inch. Von M. Moisel. In *Mitt. aus den Deutsch. Schutzgeb.*, Vol. 22, No. 3. Dietrich Reimer (Ernst Vohsen), Berlin, 1909. [The map is based upon the German Admiralty Chart No. 116 and the surveys of Vice-Gov. Berg, 1902-6. It shows the government reservation, political partitions, land forms in brown and has large nomenclature and many heights in meters.]

EUROPE

AUSTRIA-HUNGARY. Eiszeitkarte der Liptauer Alpen. 1:100,000=1.5 mile to an inch. By Dr. Roman Lucerna. No map net. Illustrates "Glazialgeologische Untersuchung der Liptauer Alpen" in *Sitzungsbericht* der k. Akad. der Wissenschaften, Vol. 117, No. 7, Part 1, Vienna, 1908. [Shows in colors the results of Dr. Lucerna's study of forms of glaciation among these mountains.]

Austria-Hungary. Karte der politischen Bezirke Melk und Scheibbs. 1:200,000=3.1 miles to an inch. 47° 40'-48° 20' N.; 14° 50'-15° 45' E. Freytag & Berndt, Vienna, 1909. [Light and shade and contours of elevation are used to give a clear picture of the relief forms. The same idea is employed on the large school map of Switzerland, published by the Federal Government. Contour interval, 50 meters. The sheet is a reduction of the large school wall map of this region issued by the same publishers.]

Austria-Hungary. (a) Karte der Österreichischen Alpenlander. 1:1,500,000=23.67 miles to an inch; (b) Karte des Erzherzogtums Österreich unter der Enns. 1:600,000=9.4 miles to an inch; (c) Karte der Umgebung von Klagenfurt. 1:150,000=2.38 miles to an inch. G. Freytag & Berndt, Vienna, 1909. [Specimens of superior school hand maps in which light, shade, colors and hachures are used to show relief forms. Many elevations are given in meters.]

Central Europe. Vergleichende ethno-geographische Karte der Deutschen in Mitteleuropa. 1:2,500,000=39.4 miles to an inch. By Dr. Willi Pessler. With paper "Deutsche Ethno-Geographie und ihre Ergebnisse." By Dr. Pessler. *Deutsche Erde,* Vol. 8, No. 8, Gotha, 1909. [Distinguishes between the low, middle and high Germans, according to speech and types of dwellings.]

France. Carte des Gisements de Coquilles comestibles des Iles de Glénan et de leurs Environs. Dressés par J. Guerin-Ganivet. *ca.* 1:14,400. Illustrates *Bull.* 154, Institut Océanographique, Monaco, 1909. [Shows the state of these fishing grounds in August, 1908.]

France. Carte des Gisements de Coquilles de la Côte du Morbihan comprise entre la rivière d'Etel et la Baie de Kerguelen. Dressée par J. Guérin-Ganivet. *ca.* 1:23.500. Illustrates *Bull.* 155, Institut Océanographique, Monaco,1909. [Shows the state of these fishing grounds in August, 1908.]

Germany. Karte zur Siedelungsgeographie des Vogelsbergs. 1:100,000=1.5 mile to an inch. By Walter Diemer. *Geog, Mitt. aus Hessen,* Heft V, Giessen, 1909. [Illustrates "Die Besiedelung des Vogelsbergs," by Mr. Diemer. Six colors for elevations. The methods of expressing social and economic data are worthy of examination. The paper is also accompanied by a map with hydrography in blue, in 1:280,000, showing the distribution of settlements without names.]

Germany. Der Selenter-See in Ostholstein. 1:50,000=0.7 mile to an inch. No map net. With "Der Selentersee in Ostholstein." By Prof. Dr. W. Halbfass. *Globus,* Vol. 96, No. 23, 1909. [A black sketch map with contours of the lake depths.]

OCEANS

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BULLETIN

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THE TECTONIC LINES OF THE NORTHERN PART OF THE NORTH AMERICAN CORDILLERA

BY

W. JOERG

[Map facing p. 178.]

The geographic world is to be congratulated on the completion of Eduard Suess's monumental work "Das Antlitz der Erde." The final volume*, published in October, 1909, in Suess's seventy-eighth year, is a splendid proof of the undiminished vigor and freshness of this master-mind. American geographers in particular will welcome the publication of the final volume, as it contains a summary of our present knowledge of the structure of North America, the completeness of which is only made possible by the investigations and surveys which have taken place since the publication, in 1885, of the volume of Suess's work which first treated of North America.

The following sketch, together with the accompanying map, is an attempt to present in outline the structural features of the northern part of the North American Cordillera, based mainly on Suess, but in part also on Brooks's valuable geography of Alaska† and on various reports of the geologic surveys of Canada and of the United States.

THE CORDILLERA. The North American Cordillera‡ is that

* Das Antlitz der Erde von Eduard Suess. Dritter Band, zweite Hälfte. Wien und Leipzig, 1909. A short review will be found in Petermann's Mitteilungen, vol. 56, p. 41 (Jan. 1910).

† The Geography and Geology of Alaska...by A. H. Brooks. Prof. Paper 45, U. S. Geol. Survey, 1906.

‡ The singular form is here used, although a decision rendered on February 6, 1907, by the United States Geographic Board prescribes the plural (a reversal, however, of its previous decision), as, irrespective of its original Spanish meaning of "mountain chain," the word is intended to denote a regional *unit*.

major geographic province of North America which occupies the Pacific side of the continent and is bounded on its outer side by the Pacific Ocean and on its inner side by the great central trough of the continent. It is preëminently a highland region and extends, from northwest to southeast, from the westernmost of the Aleutian Islands* and the mainland of Alaska to the Isthmus of Tehuantepec, at which, structurally, North America ends. The western rim of the great central trough with which the eastern border of the Cordillera is contiguous is, in its constituent parts, composed of the following sub-provinces, beginning in the north: (1) the Arctic Slope of northern Alaska, descending to the Arctic Ocean; (2) the basin of the Mackenzie River; (3) the Great Plains and, in the south, (4) the Gulf Coast, descending to the Gulf of Mexico.

The North American Cordillera, north of a depression passing south of the San Bernardino Mountains, between them and the San Jacinto Mountains (San Gorgonio Pass, 2,560 ft.), through the Salton Sink and along the Gila River and the Rio Grande—which limit separates from it its southern portion, Lower California and the Mexican Highland—is longitudinally divided into three zones which, named in order from the Pacific Ocean towards the interior of the continent, are: (1) the Pacific Mountain System; (2) the Central Plateau Region; (3) the Rocky Mountain System.

Continuation of Asiatic Structure. Such are the generally recognized sub-provinces of the Cordillera. Suess, while accepting these in principle, establishes his own divisions, being guided mainly by the structural and geologic point of view, which often leads to different results than the orographic.

According to Suess, the type of structure prevailing in northeastern Asia is continued in northwestern North America. The characteristics of the peripheral arcs of Asia recur in Alaska. The tectonic lines of the "Okhotides" [Ochotiden]†, consisting of the Aldan Range (bordering, in part, the western shore of the Sea of Okhotsk), of the Lesser Khingan Range, of the Sikhota Alin, on the western shore of the Japan Sea, and of Sakhalin Island, together with the meridional range of western Yezo, furthermore, the axes of the "Anadyrides," to which belong the Verkhoyansk Arc from its northwestern end on the right bank of the delta of the Lena to its junction with the merging ends of the Aldan and

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* Bering Island, of the Commander Islands, here so considered.

† An analogy, in English, of this rendering of the German form of the suffix is to be found in the Laurentides of the left rim of the St. Lawrence valley. It has also been adopted in the English translation of Suess's work by H. B. C. Sollas. (Cf. *Bull.* Am. Geogr. Soc., vol. 41, p. 588).

Stanovoi Ranges, the Stanovoi Range itself, and, finally, the Kurile-Kamtchatka Arc—all of these tectonic lines find their counterpart in the ranges of Alaska, to which Suess has applied the name of "Alaskides." The Alaskides have, in common with the Okhotides, Anadyrides and other peripheral arcs of Asia, both the characteristic convergence of their axes and the impingement at right angles of some of these axes upon others. Thus, the Kamtchatka-Kurile Arc impinges upon the Sakhalin-Yezo Arc in the same manner as the Aleutian Arc, in its turn, upon the Kamtchatka-Kurile Arc.

But the influence of Asiatic structure is not confined to the Alaskides alone. According to Suess, this influence persists, on the western side of the Cordillera, through the St. Elias Range to its southern end at Cross Sound, and on the eastern side of the Cordillera to no less an extent than through the whole eastern front of the Rocky Mountain System to its disappearance in the southern end of the Sierra las Vegas, or Santa Fé Range, between Santa Fé and Las Vegas, N. M.

THE ALASKIDES. The constituent parts of the structural features of the Cordillera, exclusive of Lower California and the Mexican Highland, will now be considered in detail, beginning with the Alaskides in the northwest and gradually progressing to the southeast.

To the mountain ranges of Alaska Suess has applied the name of Alaskides. The Alaskides represent a virgation or radiating ramification, which diverges towards the west and converges to the east. The western portion of this radiation is drowned; its main lines are revealed by the intervening ingression of the sea, viz.: Kotzebue Sound, Norton Sound, Bristol Bay and Shelikof Strait, together with Cook Inlet. To the east the Alaskides are limited by a zone included between the 146th and 147th meridians, where they coalesce with the Pacific and Rocky Mountain Systems, as will presently appear. Three structural axes represent the main lines of this virgation. They will be named, from north to south: Romanzof* Axis (so called by Suess), Alaska Range Axis, Kenai-Kodiak Axis.

(a) ROMANZOF AXIS. The Romanzof Axis represents an arc, concave to the north, whose eastern end probably lies in about 68 1/5° N. and 147° W. near the interlocking headwaters of the Middle and East Forks of the Chandlar River with those of the

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* After N. P. Romanzof (1754–1826), who fitted out Kotzebue's exploration expedition to the Pacific Ocean 1815–18. The name is also borne by the cape midway between the mouths of the Yukon and of the Kuskokwim and by one of the minor ranges paralleling the Romanzof Axis to the north, possibly between 142° W. and 146° W. (Cf. Brooks, Op. cit. p. 44).

Canning River, although certain other passages in Suess (iii, 2, p. 450) seem to indicate that he might also consider it to lie further to the east, possibly in 140° W. From here the arc sweeps to the west and terminates in Cape Lisburne; its continuation, Suess believes to be found in northeastern Siberia and in the New Siberian Islands with their predominating north-northwest trend.

The Romanzof Axis embraces the Endicott Range, the De Long Mountains, the Baird Mountains and the Waring Mountains.

The Endicott Range constitutes the main part of the Romanzof Axis; it may here be considered as extending from the eastern end of the latter to the interlocking headwaters of the Noatak and Kobuk Rivers.

The De Long Mountains are an outer, northern branch of the Endicott Range and terminate in Cape Lisburne, while the Baird Mountains, between the Noatak and Kobuk Rivers, and the Waring Mountains, south of the latter river, represent southern branches.

(b) Alaska Range Axis. The Alaska Range Axis begins south of the upper Tanana River at the Nabesna River and swings in a mighty curve, convex first to the north and then to the south and roughly 2,500 miles long, through the Aleutian Islands to their western end. It includes—if, in keeping with Suess's postulate with regard to the naming of mountain ranges, soon to be mentioned, we consider the Alaska Range as beginning at the Delta River—the following: Mentasta Range, Alaska Range, Chigmit Mountains, Aleutian Range, Aleutian Islands.

The Mentasta Range lies between the Nabesna and Delta Rivers and is a direct continuation on the southeast of the axis of the Alaska Range. It, in its turn, is continued to the southeast by the Nutzotin Mountains, which may be considered as ending at Kluane Lake. The Alaska Range sweeps in a bold curve, convex to the north, from the Delta River to the northern end of Lake Clark. It carries the highest summit of the continent, Mount McKinley, 20,300 ft. in elevation. Overlapping its southwestern end on the inner side lie the Chigmit Mountains*, which form a connecting link between the Alaska Range and the Aleutian Range. They seem to have the tendency to develop longitudinal valleys. The Aleutian Range forms the axis of the Alaska Peninsula and lies on its Pacific side. It extends from Cape Douglas, where its northeastern end is offset to the east with reference to the axis of the Chigmit Mountains, to Unimak Pass in the southwest. From here

* Brooks, *op. cit.* p. 33 and Plate VII.

the chain of the Aleutian Islands extends, in its structural axis, to Bering Island of the Commander group.

(c) KENAI-KODIAK AXIS. The Kenai-Kodiak Axis is here considered to begin at the Copper River, from which it extends parallel to the Alaska Range Axis and includes the Chugach Mountains, the Kenai Mountains and Afognak and Kodiak Islands.

The Chugach Moutains enclose Prince William Sound to the north in an arc concave to the north; the transverse depression of Turnagain Arm and of an east-west fiord of Port Wells, which confine the Kenai Peninsula at its neck, may be considered their southwestern limit. From here the Kenai Mountains, lying on the oceanic side of Kenai Peninsula and forming its backbone, trend to the southwest and find their continuation in Afognak and Kodiak Islands with an offset to the east similar to that which the Aleutian Range undergoes with reference to the Chigmit Mountains.*

INTERVIRGATIONAL STRUCTURE. The Seward Peninsula probably also represents a branch of the virgation† and undoubtedly constitutes a connecting link, structurally, between North America and Asia. But evident as is this connection in the general relationship, yet it is difficult directly to determine the same between the Seward Peninsula and the Chuckchee Peninsula of Siberia, of which the former is doubtless a continuation. This difficulty lies in the fact that the Seward Peninsula is less a region of well-marked tectonic lines than one of local intrusions of various geologic periods.

The Yukon Hills, south of the Koyukuk River, the Gold Mountains, between the Melozi and Yukon Rivers, and the Kaiyuh Mountains, paralleling the Yukon on the left along its south-southwestern course may be considered as minor ramifications of the virgation, included between its major axes.

The Kuskokwim Mountains, of plateau-like character and with a general southwestern trend, possibly crossed by the Kuskokwim River in 62° N., together with their southern continuation, the Ahklun Mountains, terminating in Cape Newenham, Suess does not consider as a branch of the virgation; they are an extraneous element.

COALESCENCE OF THE ALASKIDES. To the east the Alaskides are limited by their coalescence [Scharung]‡ with the ranges of the Pacific and Rocky Mountain Systems. This coalescence takes place

* Caused by a zone of fracture of northwest strike from Kamishak Bay to the passage between Afognak Island and Kenai Peninsula? W. J.

† Cf. varying statements in Suess III, 2, p. 395 and p. 426.

‡ Rendered by "syntaxis" in the translation by H. B. C. Sollas.

in a zone extending northward from Prince William Sound, between 146° W. and 147° W. to the Arctic Ocean. To this coalescence, Suess has given the name of Coalescence of Chugach* after the Innuit appellation of Prince William Sound, a form still retained in the name of the Chugach Mountains. To the west of this coalescence the general trend of the mountain axes is southwest, gradually changing to west-southwest and finally west-northwest in the northern (Romanzof) branch of the Alaskides; to the east of the coalescence the general trend is southeast. All of the important ranges of the interior are to a certain extent subjected to this influence, which is most conspicuous on the coast of the Pacific Ocean, where the tectonic lines meet nearly at right angles, enclosing the Gulf of Alaska.

The Alaskides coalesce in their southern branch, the Kodiak-Kenai Axis, with the Pacific Mountain System to the north of Prince William Sound where, as the Chugach Mountains, they imperceptibly merge into the St. Elias Range.

With the Rocky Mountain System the Alaskides coalesce in their central and northern branches, the Alaska Range Axis and the Romanzof Axis, respectively. The Alaska Range does not directly merge with the main axis of the Rocky Mountain System, as is the case in the southern coalescence, but their two respective ends overlap. The Alaska Range with its southeastern continuation, the Mentasta and Nutzotin Mountains, comes into lateral contact with the northwestern end of the main axis of the Rocky Mountain System, which terminates in 147° W. between the small Chena River and the Tanana River, the latter forming the division between the two axes.

The coalescence of the northern branch of the Alaskides, the Romanzof Axis, with the eastern axes of the Rocky Mountain System is considered to take place either in 147° W. or 140° W., according to which view is entertained with regard to its eastern end, as referred to above.

According to Suess it seems probable that a fault zone separates the Mentasta Range from the Nutzotin Mountains and another the Chugach from the Kenai Mountains, the former with a northwest-southeast strike, the latter with a northwest-southwest strike, reflecting the trend of the axes on both sides of the zone of coalescence.

Alaskides a Tectonic Unit. To Suess, the Alaskides represent a tectonic unit. Every coalescence exhibits the result of two oppos-

* "Tschugatsk" in the original.

ing dynamic influences. Therefore, it should be considered a boundary, and, accordingly, the name of no mountain range should be extended beyond it. Thus, for the Alaskides, Suess cannot accept Brooks's tripartition into Pacific Mountain System, Central Plateau Region and Rocky Mountain System. He nevertheless recognizes the great similarity of axial structure on both sides of the zone of coalescence, and he appreciates the factors that have led to the extension into Alaska of the subdivisions of the Cordillera in the United States and Canada. Indeed, his assumption of the persistence of Asiatic structure in the Rocky Mountains involves the recognition of this similarity, which is visible in the analogy of arrangement and of direction of folding between the respective outer and inner axes of the Alaskides and of the ranges to the southeast of the zone of coalescence. On the one hand, namely, the outer arcs of the Alaskides (Kodiak-Kenai and Alaska Range Axes) are concave to and face the Pacific Ocean, the direction of folding being toward it, while, on the other, the inner arc (Romanzof Axis) is concave to and faces the Arctic Ocean, being folded towards the north; both find their counterparts in the St. Elias Range, which faces the Pacific and is folded toward it, and in the eastern ranges of the Rocky Mountain System, which face towards the interior of the continent and are folded toward the east.

St. Elias Range. The St. Elias Range, which does not belong to the Alaskides but lies to the east of the zone of coalescence, extends from the Copper River to Cross Sound. It forms a high, rugged coastal barrier, attaining extreme elevations in its culminating peaks (Mount Logan 19,500 ft., Mount St. Elias 18,024 ft., Mount Fairweather 15,387 ft.). Between its base and the coast lies a shelving coastal plain, at times 20 to 30 miles wide and in many places covered by huge glaciers.

Provisional Character of Nomenclature. The terminating limits of mountain ranges and axes, as given in the above, should, of course, be merely considered as tentative. Even Suess's statements do not always allow of a definite conception of the extent of the various ranges, a fact which is quite comprehensible in view of the conflicting condition of the nomenclature of the region under consideration, due on the whole to—at least for such purposes—inadequate knowledge concerning the objects to be named. This at times leads even to a divergence of conception in the works of the same author, as expressed in the text or on the accompanying maps. Furthermore, even ample knowledge of a mountain region does not

always insure an indisputable delimitation of its component parts, as witness the problem of the boundary between the Alps and the Appennines, still awaiting a solution satisfactory to all.

The "Inter-Mountains." All of the ranges to the west of the zone of coalescence belong to Suess's system of the Alaskides. To the southeast of this zone and enclosed between the St. Elias Range on its western and the Rocky Mountain System on its eastern side lies the beginning of one of the nine major structural provinces* into which Suess has divided the "face of the earth"—a province to which he gives the name "das Zwischengebirge," here provisionally rendered by "the Inter-Mountains." It extends obliquely through the whole Cordillera from its Pacific to its Atlantic side, *viz.:* from the zone of coalescence to the Sierra Madre del Sur, on the southern rim of the Mexican Highland, through approximately forty-three degrees of latitude. It is bounded on the west by the St. Elias Range, the "Vancouver Axis" mentioned below, the Coast Ranges of the Pacific Coast of the United States (which represent the beginning of Andine structure), Lower California, the Sierra Madre del Sur; on the east by the Rocky Mountain System, where, in the south, the outer scarp-rim of the Wasatch Mountains and the Colorado Plateau form its eastern boundary. It includes the Wrangell Mountains, the Skolai Mountains, the Alexander Archipelago, the Coast Range and the Interior Plateaus of British Columbia, the Cascade Mountains, the Sierra Nevada, the granitic areas of Oregon and Idaho, the ranges of the Great Basin and the Mexican Highland, as which it reaches the Gulf of Mexico. It is therefore amply evident that it does not coincide with any of the recognized subdivisions of the Cordillera; it includes portions of the Pacific Mountain System, the greater part of the Central Plateau Region and even parts of the Rocky Mountain System, as will appear. The principles underlying its delimitation are structural and geologic, not orographic or topographic. Its structural relation to the other provinces cannot be dwelt upon here. As a unit it is characterized by pre-Carboniferous formations, by old intrusive rocks, by folding and faulting and by recent vulcanism.

Constituent Parts of the Inter-Mountains. The Wrangell Mountains are a well-defined group of, in part, still active volcanic mountains of roughly elliptical shape, 100 miles long and 70 miles broad, and with west-northwest and east-southeast trend. On the northeast they are separated from the Mentasta Range and the

* Suess, III, 2, pp. 573 seq.

Nutzotin Mountains by a well-marked depression continuing the upper valley of the Copper River across the transverse valleys of the Nabesna and Chisana. To the northwest and southwest they are enclosed by the bend of the Copper River, the lower part of which is continued to the southeast by the Chitina River.

Mesozoic rocks, which form the southern base of the Wrangell Mountains, chiefly compose the Talkeel Mountains,* a group with southwestern trend that lies between the Matanuska River on the south and the upper Sushitna on the north. As the Aleutian Range on its Pacific side also consists of Mesozoic rocks, the Talkeel Mountains, geologically at least, may be considered as a connecting link between the Wrangell Mountains and the Aleutian Range.

Between the Alaska Range and Mentasta Range on the north, the Wrangell Mountains on the east, the Chugach Mountains on the south, the Talkeel Mountains on the west, lies the Copper River Plateau, an extensive level tract of about 2,200 ft. mean elevation.

To the southeast the Wrangell Mountains are continued by the Skolai Mountains which trend southeast and merge with the St. Elias Range. The Skolai Mountains afford a typical example of the still prevailing conflicting nomenclature. Brooks would seem to consider them as lying to the south of the Nutzotin Mountains, between these and the Wrangell Mountains, and forming a connecting link between the eastern continuation of the Alaska Range and the St. Elias Range† and so indicates them on Plate VII, while R. U. Goode's map of Alaska‡ accompanying the same report interprets them in the above sense as a southeastern continuation of the Wrangell Mountains, in concurrency with Suess.

Eruptive rocks occur in the greater part of the Alaska Range Axis from the Aleutian Islands through the northwestern longitudinal half of the Alentian Range to the Chigmit Mountains and embrace furthermore the main massif of the Wrangell Mountains. In fact, the Wrangell Mountains, although not geographically connected, may be considered a northeastern continuation of the volcanoes of the Aleutian chain. According to Suess, this is the only known case of a coalescence being accompanied by a line of active volcanoes (Wrangell Mountains).

In their northwestern part, the Inter-Mountains comprise the

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* Cf. Brooks, *op. cit.* Plate XXI.

† Brooks, *op. cit.* pp. 29, 31, 32, 34, 35, 36, 255.

‡ Map of Alaska compiled under the direction of R. U. Goode by E. C. Barnard and others. 1:2,500,000. contours; interval 1,000 ft. The excellent reduction to 1:5,000,000 with much additional information, relief in shading and lowland below 1.000 ft., in green tint, published as Plate I, *Petermann's Mitteilungen*, 1907, should also be consulted.

Alexander Archipelago. Here occur large areas of massive igneous rocks, chiefly of effusive origin,* which may be considered as extensions from the main body of the batholith.

The Inter-Mountains further comprise an intrusive batholith of great length to which Suess has given the name of [British] Columbian Granodiorite. It extends through fourteen degrees of latitude from 63° N. to just south of the boundary between Canada and the United States. It is practically coextensive with the Coast Range of British Columbia and embraces the entire area, colored to indicate "coast granite" on the "Western Sheet of the Geological Map of the Dominion of Canada" (scale 1:3,171,000), published by the Geological Survey of Canada, with the exception of a narrow zone of sedimentary rocks which occupy the coast from the head of Lynn Canal to Dixon Entrance.† It extends in a belt increasing in width from 30 miles at 141° W. to 100 miles in the south, from the northern front of the Nutzotin Mountains, across the Naberna and the upper White River, past Lakes Kluane and Dezadeash, paralleling the coast as far as the bend of the lower Fraser. Here the batholith retreats from the coast and dwindles to a narrow end, which projects to the south of the Canada-United States boundary and forms the nucleus of the Skagit Mountains, which lie to the west of the upper Skagit River, being crossed by its middle course, and constitute a subdivision of the northern end of the Cascade Mountains.

Here, superimposed on the granite, begins, with Mt. Baker, the meridional line of andesitic volcanoes of the Cascades which extend nine degrees to the south and include Lassen Peak. South of Lassen Peak the Cascade Mountains are continued by the Sierra Nevada. Both the Cascade Mountains and the Sierra Nevada form a part of the Inter-Mountains.

To these also belong Dawson's Interior Plateau of British Columbia.‡ It lies between the Coast Range and the Rocky Mountain System and extends, with a length of 500 miles and an average width of about 100 miles, from Babine Lake southeast to just south of the Canada-United States boundary in the Okanagan Valley. In early Tertiary time it had been base-leveled to a peneplain. This peneplain "has never since been entirely obliterated, although . . . it has been an area of deposition of strata and the theatre of

* Brooks, *op. cit.*, p. 226.

† Cf. Brooks, Plate XXI.

‡ Cf. *inter alia.* Annual Report Geol. Surv. Canada, vol. VII (new series), 1894, pp. 4–9 B.

great volcanic eruptions."* According to Suess, this Tertiary peneplane lies horizontally over the north-northwest trending and folded rocks of the Inter-Mountains.

The eastern boundary of the Interior Plateau, as far as determined, may be taken with Daly† to follow in its salient features the Quesnel River, Adams Lake and the Kettle River. To the east of it lie the orographic units established by Daly which, according to the definition of the Rocky Mountain System here entertained, belong to this major subdivision of the Cordillera. Suess, however, includes in the Inter-Mountains the western half of Daly's Columbia System, the unit lying immediately to the east of the Interior Plateau, so that here their eastern boundary lies approximately along the western base of the Gold Range, a subdivision of the Columbia System and, possibly, along the North Fork of the Kettle River and Christina Lake (118 1/5° W.). This important tectonic boundary between the Rocky Mountain System and the Inter-Mountains is marked by no structural feature of note; no fault line separates the two divisions.

In the south the Inter-Mountains are represented by the granite area of Oregon and that of Idaho. To the former belong the Blue Mountains which, although separated from it by the basalt through which the Snake River has eroded its canyon, are technically continuous with the granite mass of Idaho. The latter, a post-Triassic intrusive batholith of a width, at times, of 100 miles, includes in the north the meridional section of the Bitterroot Mountains south of Lolo Pass, which separates the granite from the Algonkian sedimentary terrane of Lindgren's "Cœur d'Alene Mountains"‡ to the northwest. On the east, this part of the batholith is bounded by the fault of the Bitterroot Valley, which, according to Suess, separates it from the Rocky Mountain System. A division based on orographic principles, however, would place the western limit of the latter farther to the west, at the eastern edge of the Columbia Lava Plain and the Snake River Basalt, thus including the Bitterroot Mountains, while the Bitterroot Valley, from the point of view of this classification, represents merely a boundary between subdivisions. In the south the eastern edge of the batholith extends as far as Hailey (114¼° W.; 43½° N.); its southern front continues west-southwest and includes the Owyhee Mountains.

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* Ibid., p. 5, B.

† R. A. Daly: The Nomenclature of the North American Cordillera between the 47th and 53rd Parallels of Latitude. *Geogr. Journ.*, vol. 27 (1906, 1), pp. 586–606. Map, p. 588.

‡ W. Lindgren: A Geological Reconnaissance across the Bitterroot Range and Clearwater Mountains in Montana and Idaho. U. S. Geol. Surv., Prof. Paper 27, 1904.

These various subdivisions of the Inter-Mountains, viz.: the Cascades, the Blue Mountains, the granite batholith of Idaho, although isolated, are structurally one, their connecting parts having been overflowed and obscured by the Miocene lava flows which created the Columbia Lava Plain and the Snake River Basalt.

Western Boundary of Inter-Mountains. To the west the Inter-Mountains are, it will be remembered, bounded by the St. Elias Range, the "Vancouver Axis," the Coast Ranges, Lower California and the Sierra Madre del Sur. The St. Elias Range has been previously referred to, while the two last mentioned parts of the western boundary of the Inter-Mountains are not included in the scope of the present discussion.

The "Vancouver Axis" embraces the Queen Charlotte Islands and Vancouver Island. According to Suess, they are not a continuation of the Alexander Archipelago, but an independent mountain system similar to the Inter-Mountains and lying to the west of them.*

The Coast Ranges of the Pacific Coast of the United States—which should, of course, not be confused with the Coast Range of British Columbia from which they are entirely distinct—are characterized by an *échelon* alignment of their axes, which is typical of the structure of the Pacific Coast, beginning with the Queen Charlotte group and extending far to the south.

Inter-Mountains Not a Geographic Province. Such, then, is the extent of the Inter-Mountains. In conclusion it may be stated that, as justifiable as is their establishment as a unit from the structural point of view, yet a division, based on geographic principles, cannot recognize them as a natural province. The above considerations as to their nature and extent do not, therefore, modify the system of subdivisions of the Cordillera suggested at the beginning of this paper.

Rocky Mountain System. There remains to be discussed a major subdivision of the Cordillera, the Rocky Mountain System. According to Suess its northern end is marked by its coalescence with the Alaskides; in the south it has previously been defined as extending to the Rio Grande. Whether, however, the mountain ranges of the region, enclosed by the Pecos and the Rio Grande, above its confluence with the former, should not be excluded from the Rocky Mountain System because of the similarity of their habitus to that of the ranges of the adjoining portion of the Mexican

* III, 2, p. 466. Cf., however, conflicting statement on p. 467.

Highland will, in the present paper, be left an open question. Suess inclines to this view* and considers this region as a spur of the Inter-Mountains. Powell, on his map of the physical divisions of the United States,† also classifies as a separate province the "Pecos Plateaus," which embrace a part of the region under consideration, while Davis‡ includes it in the equivalent of the Rocky Mountain System.

On the east, the Rocky Mountain System is bounded by the great central trough of the continent in its contiguous parts, the Mackenzie Basin and the Great Plains, as before stated. On the west it is bounded by the Central Plateau Region. The eastern limit of the latter, which coincides with the eastern limits of its subdivisions, will evidently be the western boundary of the Rocky Mountain System. This boundary has before been roughly indicated with respect to its northern and central subdivisions, the Interior Plateau of British Columbia and the Columbia Plateaus (as the central subdivision will here be termed, in keeping with Powell's and Davis's classification;§ it includes, therefore, the Columbia Lava Plain, Snake River Basalt and the greater part of Suess's granitic mass of Idaho). The question as to the eastern boundary of the southern subdivisions of the Central Plateau Region must also, for the time being, be left unanswered. Some of the points to be decided in this connection may, however, be indicated. They are, whether, on the one hand, the Wasatch Mountains (which undoubtedly form the eastern boundary of the Great Basin), together with the region which lies between them and the Rocky Mountains of Colorado and south of the Uinta Mountains—the drainage basin of the lower Green and Grand Rivers and of the upper Colorado—and, on the other, the Colorado Plateau, should both be considered as belonging either to the Central Plateau Region or to the Rocky Mountain System. If the basin of the lower Green and Grand Rivers, the Colorado Plateau and the region between the Rio Grande and the Pecos, be not counted in the Rocky Mountain System, then, in its southern portion, it would be bounded on the west by the western base of the Rocky Mountains of Colorado and on the south by the upper San Juan River and the Rio Chama, and would finally come to a tapering end in 35° 30′ N. as the Santa Fé Range, previously referred to.

* III, 2, p. 491.

† J. W. Powell: Physiographic Regions of the United States. National Geographic Monographs. Vol. I, No. 3 (pp. 65–100), 1895. Map on pp. 98–99.

‡ The International Geography, edited by H. R. Mill, 1909. Map p. 719.

§ Maps of *Op. cit.*

Contact with Pacific Mountain System. To the north of the east-west course of the Columbia River in 48° N. the Rocky Mountain System and the Pacific Mountain System come into contact for about one degree of latitude, thus separating the Central Plateau Region into two halves, the Interior Plateau of British Columbia lying to the north, the Columbia Plateaus to the south of the zone of contact. Probably the Okanagan Valley below Osoyoos Lake (49° N.) represents the boundary between the two systems.

Characteristics. The general trend of the ranges of the Rocky Mountain System is southeast—varying at times to south-southeast—from its coalescence with the Alaskides in the north to about 42° N. where the Laramie Range bends to the south. From this point southward the Rocky Mountain System, as a unit, assumes a meridional trend.

A characteristic of the ranges composing the Rocky Mountain System, which persists throughout its entire extent, is their alignment *en échelon,* i. e., the arrangement of a series of roughly parallel ranges in such a manner that the end of one projects beyond the end of the next, so that their front presents a step-like ground plan. This arrangement is particularly evident in the eastern front of the system, especially in the portion with meridional trend. Here the north-south axes have the tendency to bend to the north-northwest at their northern ends and to form a virgation. Their main trunks, however, with their north-south trend, preserve the straight front of the whole system towards the Plains. But, due to their *échelon* character, this continuity of their front is interrupted by reentrant angles at every merging of the southern end of one range with the northern end of the next. Suess here distinguishes four axes which are aligned *en échelon* to each other: (1) the Laramie Range; (2) the Medicine Bow Range and the Front Range; (3) the Park Range, the South Park Range and the Wet Mountains; (4) the Sawatch Range, the Saugre de Cristo Range, the Culebra Range and the Santa Fé Range.

Arrangement *en échelon* is also evident on the western side of the Rocky Mountain System. The ranges lying between the basin of the upper Green River and the Snake River Basalt show the same tendency as those of the eastern front to bend towards the northwest, at the northern end of their meridional axes, until they disappear under the basalt floods of the Snake River basin.

Two Longitudinal Belts. The Rocky Mountain System, in its northern portion, may be considered to consist roughly of two

longitudinal belts, an inner (with reference to its relative position in the Cordillera) or western and an outer or eastern one.

It is to the outer belt that the name "Rocky Mountains" has always unreservedly been given. It is only with growing recognition of the fact that the Rocky Mountains are merely a part of a larger system that their name, in the form of "Rocky Mountain System,"* has been extended to include the whole system. And this is only just, inasmuch as the part with which a definite conception was first associated—because of the westward movement of exploration and settlement and, in part, because of the well-defined character of, at least, its eastern boundary—should give its name to the whole, after it has once been recognized as a part of that whole. On the other hand it does not seem conducive of greater clarity of conception to withhold the name of Rocky Mountain System from the whole mountainous belt lying between the Interior Plateau of British Columbia and the Great Plains, as some Canadian geologists do, especially as the terms they are constrained to resort to, such as "the Rocky Mountains proper" or "the main range of the Rocky Mountains," for what is here designated the Rocky Mountains (the eastern belt) seem to indicate a feeling that the name is associated with a larger conception than that corresponding to the outer belt alone.

The boundary between the inner and outer belts of the Rocky Mountain System, as far as determined, is represented by a remarkable longitudinal depression which extends for over 800 miles from the head of the Liard River to Flathead Lake, Montana. The streams flowing in it drain it, in general, alternately in opposite directions, indicating the absence of a continuous gradient. They are, from north to south: Kachika River (flowing N.W.), Tochieca River and its trunk stream, Finlay River (both S.E.), Parsnip River (N.W.), upper Fraser River (N.W.), Canoe River (S.E.), upper Columbia River (N.W.), upper Kootenay River (S.E.), lower Tobacco River (N.W.) and Stillwater River (S.E.), which flows into the Flathead River, a short distance above its emptying into Flathead Lake. The continuation of this trough to the south may possibly be found in the depression accompanying the western foot of the Mission Range and in the Bitterroot Valley. To this dominant

* Daly uses this term (*Op. cit.*, p. 592 and p. 604) to designate what is here called the outer or eastern belt. It may be added that he wishes the term "Pacific Mountain System," if at all used, applied as a variant for the Cordillera because of its being pre-eminently "a Pacific feature of the globe" (pp. 591 and 592). Davis uses "Rocky Mountain System" in the sense in which "the Cordillera" is here used (*Op. cit.*. p. 671) and designates by "Rocky Mountains" (Map p. 719) the equivalent of "Rocky Mountain System" in the present paper.

feature Daly has felicitously given the name of "Rocky Mountain Trench."* As to its structural significance, Suess is not willing to decide; the only at all comparable phenomenon is that of the "Scandinavian Line."†

Western Belt North of 52° N. The axis of the inner or western belt of the Rocky Mountain System begins between the Chena and Tanana Rivers in 64½° N. and 147° W. and extends in an east-southeastern direction that gradually changes to southeast across the meridional course of the Yukon above the Klondike River, then, crossing obliquely the lower courses of the Stewart and Pelly Rivers, continues as the Cassiar Mountains across the Dease River, an affluent of the Liard, forms the backbone of the mountains lying to the west of the Finlay and Parsnip Rivers and, as the Cariboo Range, reaches the bend of the Columbia River in 52° N., where the Rocky Mountain System expands into a virgation to the south.

Eastern Belt North of 52° N. The main axis of the outer or eastern belt of the Rocky Mountain System may be considered as beginning on the eastern side of the Yukon, between the Klondike and Tatonduk Rivers. From here to the interlocking headwaters of the Stewart and Gravel Rivers it is known as the Ogilvie Range.‡ It has an east-southeast trend. Continuing it on the east and extending to the southeast to an unknown distance lies the Selwyn Range.§ The Ogilvie and Selwyn Ranges carry the Yukon-Mackenzie watershed.

The Tanana Hills north of the lower Tanana (Suess's Ketchumstock Mountains?‖ may possibly be a western continuation of the Ogilvie Range. In this case they would represent the westernmost extension of the Rocky Mountain System.

Towards the Mackenzie the Ogilvie and Selwyn Ranges are limited by a scarp-like front which rises abruptly from the plateau below. This, together with the fact that the front is in part formed by the outermost of the sub-ranges trending parallel to the main range, has led to their being taken for the continuation of the main range of the Rocky Mountains. The average elevation of

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* *Op. cit.* p. 596.

† The eastern boundary of the gneiss area of southwestern Sweden, extending through five degrees of latitude from the coast in 15° 20′ E. past the southern end of Lake Wetter, along the eastern shore of Lake Wener and up the Klar-Elv. Cf. III 1, p. 479.

‡ Cf. J. Keele: Upper Stewart River (Report C) and C. Camsell: Peel and Wind Rivers (Report CC), *Annual Report* Geol. Surv. Canada, vol. XVI (new series), 1904.

§ R. G. McConnell: The Macmillan River. *Annual Report* Geol. Survey Canada, vol. XV (new series), 1902–93, p. 26A, and J. Keele's report.

‖ III, 2, p. 453.

2,000 to 3,000 feet for these frontal sub-ranges, as compared to that of 7,000 to 8,000 feet for the Ogilvie and Selwyn Ranges, should afford a criterion for their relative valuation. The Selwyn and Ogilvie Ranges are here considered the continuation of the Rocky Mountains or outer belt of the Rocky Mountain System. On the accompanying map, therefore, the lines bounding the Mackenzie Basin on the west should be interpreted as the limit of the mountainous region of which the Ogilvie and Selwyn Ranges represent the axes, and not as mountain axes themselves.

In 136° W. this scarp-like front, which, to the east of this point has an east-southeastern trend, suddenly swings due north and meets the delta of the Mackenzie, enclosing a large semicircular tract of a mean elevation of 1,700 feet, termed the Peel Plateau, and drained by the river of that name. On its approach to the Arctic Ocean the scarp-front bends to the northwest and then to the west, assuming the trend dictated by the coalescence. The scarp is here known as the Richardson, Buckland and Franklin Mountains. They probably bear to the Romanzof Axis the same relation as the scarp of the Mackenzie Basin to the Ogilvie and Selwyn Ranges. According to Suess, they represent the northernmost ranges with which the Rocky Mountain System coalesces with the Alaskides.

The heights accompanying the right bank of the Mackenzie and extending from its bend in 62° N. to its bend in 66° N. may also be considered as sub-ranges or outliers of the Rocky Mountain System.

To the south of the Liard River, where the mountains are again marshalled into a solid phalanx, the main axis of the outer belt, or Rocky Mountains, extends to the southeast across the upper Peace River, and the depression occupied by the headwaters of the Fraser and Athabaska Rivers, connected by Yellowhead Pass.

WESTERN BELT SOUTH OF 52° N. South of this region and the bend of the Columbia River, the Rocky Mountain System expands into a greater number of diverging ranges. In the inner belt, the Gold Range, with its continuation, the Colville Mountains, and the Selkirk Range, with its minor offshoots, the Slocan Mountains* and the Pend Oreille Mountains, about on the Columbia Lava Plain. Between the Selkirk Range and the Rocky Mountain Trench lies the Purcell Range. To the south these are continued on one side of Clarks Fork by the Bitterroot Mountains, on the other by the Cabinet and Flathead Mountains. Confusion prevails with regard to the limits of the Bitterroot Mountains. The United States Geo-

* Daly, *Op. cit.* p. 602 and Map p. 588.

graphic Board* includes under this term the entire range whose crest forms the boundary between Idaho and Montana, from Pend Oreille Lake to the crossing of the Oregon Short Line near 112° W. Lindgren† wishes the name restricted to the section between Lolo and Nez Percé Passes, while R. U. Goode‡ applied the name to the section between Pend Oreille Lake and South Pass, slightly farther south than Nez Percé Pass and at the head of the Bitterroot River.

Eastern Belt South 52° N. The outer or eastern belt of the Rocky Mountain System, south of the bend of the Columbia, is continued by the "Canadian Rockies" proper, by the Livingston and Lewis Ranges and the ranges accompanying them on the west: the Galton Range, the Swan Range and the Mission Range, the meridional axis of the latter forming an angle with the prevailing south-southeastern trend.

South of the bend of the Missouri River, and extending to the plateau of Yellowstone Park, the ranges of the outer belt undergo a decided change in character. Instead of the prevalence of long ranges of the folded type, aligned *en échelon,* which obtain to the north and south, this region is structurally distinguished by the presence of faults and dislocations which have created mountains of the block type. To this structural category belong the Big Belt Mountains, the Little Belt Mountains, with their continuation, the Big Snowy Mountains, the Bridger Range, the Snow Mountains, the Beartooth Mountains.

Rocky Mountain System South of 47° N. To the west of this zone lies the granitic mass between Helena and Butte, the mountains lying on the western side of Deerlodge Creek and those bounding the Bitterroot Valley on the east. To the south lie the Jefferson Range, continuing the Helena-Butte mass, the Madison Range and the Gallatin Range, continuing the Bridger Range.

On the west the plateau of Yellowstone Park is bounded by the Teton Range, which meets the ranges already referred to as bordering the Snake River Basalt *en échelon* to the east and forming a connection with the Wasatch Mountains, while on the east it is bordered by the Absaroka Range, which, with its continuation, the Owl Mountains, bounds on the west and south the Bighorn Basin, of which the Bighorn Mountains form the eastern rim.

Beginning with the Gros Ventre Range on the eastern side of the Snake River, just below its issue from Jackson Lake, the axis of the

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* As "Bitterroot Range," decision of Feb. 6, 1907.

† *Op. cit.*

‡ Bitterroot Forest Reserve. Nat'l Geogr. Mag. Vol. IX (1898), p. 391.

Wind River Range trends to the southeast and forks at its eastern end, where its northern branch, the Rattlesnake Mountains, forms the connecting link with the Laramie Range, previously mentioned, and its southern branch, the Sweetwater and Seminole Mountains, with the Medicine Bow Range, already alluded to. These ranges lead over to the mountains of Colorado.

Conclusion. Revision of the Subdivision of the Cordillera. Under the guidance of Suess we have thus obtained a rapid general survey of the North American Cordillera, north of the Gila and the Rio Grande, the unequal character of which is, in part, due to the inequality of our knowledge of the region and in part to limitations set by the present field of investigation of the writer.

In conclusion it seems worth while to reconsider the subdivision of the Cordillera into major geographic provinces, in the light of Suess's work, in order to ascertain whether a modification of the present scheme does not seem advisable. From this point of view the writer would suggest establishing the Alaskides as a separate province, of major rank as a subdivision of the Cordillera. The North American Cordillera, extending from Bering Sea to the Isthmus of Tehuantepec, would, therefore, fall into three major subdivisions: (1) the Northern Cordillera, or the Alaskides; (2) the Central Cordillera; (3) the Southern Cordillera, or Lower California and the Mexican Highland. The boundary between the first and second divisions would be the zone of coalescence, between the second and third the depression previously referred to along Salton Sink, the Gila and the Rio Grande.

The Central Cordillera would be further subdivided into three longitudinal provinces, viz.: (1) the Pacific Mountain System; (2) the Central Plateau Region; (3) the Rocky Mountain System.

In the north the Central Plateau Region would come to a tapering end, enclosed by the Alaska Range Axis and the axis of the inner belt of the Rocky Mountain System coalescing along the upper Tanana River. This delimitation differs from that of Brooks. It seems justified, however, as, even without establishing the Alaskides as a separate province, and even when considering the Central Plateau Region as extended to the west, between the Romanzof and the Alaska Range Axis, this province is so constricted at the point referred to that it naturally resolves itself into two halves. And, finally, the boundary between two opposing forces implied by every coalescence and the decided Asiatic structure of the Alaskides, would seem amply to justify the recognition of the Alaskides as an independent major subdivision of the Cordillera.

TRADE ROUTES IN THE ECONOMIC GEOGRAPHY OF BOLIVIA*

(*Concluded*)

BY

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PARAGUAY-SANTA CRUZ

One of the oldest trade routes in South America is that from the plateau section of Bolivia to the Paraguay. Three facts have in the past restrained trade from following this route in increasing amounts. The Gran Chaco, across which the way lies, is insufficiently watered, except in its northern part. It forms an extension into Bolivia of the piedmont plains of Argentina, and its porus sands and gravels absorb the limited rainfall and thus diminish the value of the tributaries of the Paraguay for purposes of navigation. The flood plains are either inundated or too dry; the channels of the streams are marked in the dry season by innumerable snags and shallow and braided water courses. The hostility of the Indians of some sections of the region has been a second source of discouragement, while a third has been the directer course which the Amazon and its tributaries afford to European markets, besides their greater navigability at all seasons of the year on account of their location in a belt of heavier and more constant rainfall.

Repeated attempts have been made to develop some route to the Paraguay. Early in the history of the Spanish missions a cart road was opened to the present location of Santa Cruz, one of the most isolated cities in Bolivia to-day. Crevaux, the Stanley of South America, lost his life in 1882, in trying to explore the possibilities of the Pilcomayo.† Only in 1905-1906 was that river finally explored to the satisfaction of the Bolivian and Argentinian interests and found to be wholly unsuited to transportation on a commercial scale.‡ In 1879 Minchin§ opened up 50 miles of track through

* See *Bulletin*, January, p. 22, and February, p. 90.

† Süd und Mittel Amerika; W. Sievers, 1903, p. 29.

‡ The River Pilcomayo from its Discharge into the River Paraguay to Parallel 22° S. Gunnar Lange. Buenos Aires, 1907. See also El Comayo. S. V. Guzman. Buenos Aires, 1880.

§ Eastern Bolivia and the Gran Chaco. J. B. Minchin. *Proc.* Royal Geog. Soc. (London), vol. 3, 1883, p. 410.

dense, dry thorny scrub to the Parapiti from San José. No water could be found in all this distance, while borings to 26 feet were likewise unsuccessful. He describes the Indians as able to sustain themselves for long periods by the water found between the vertical

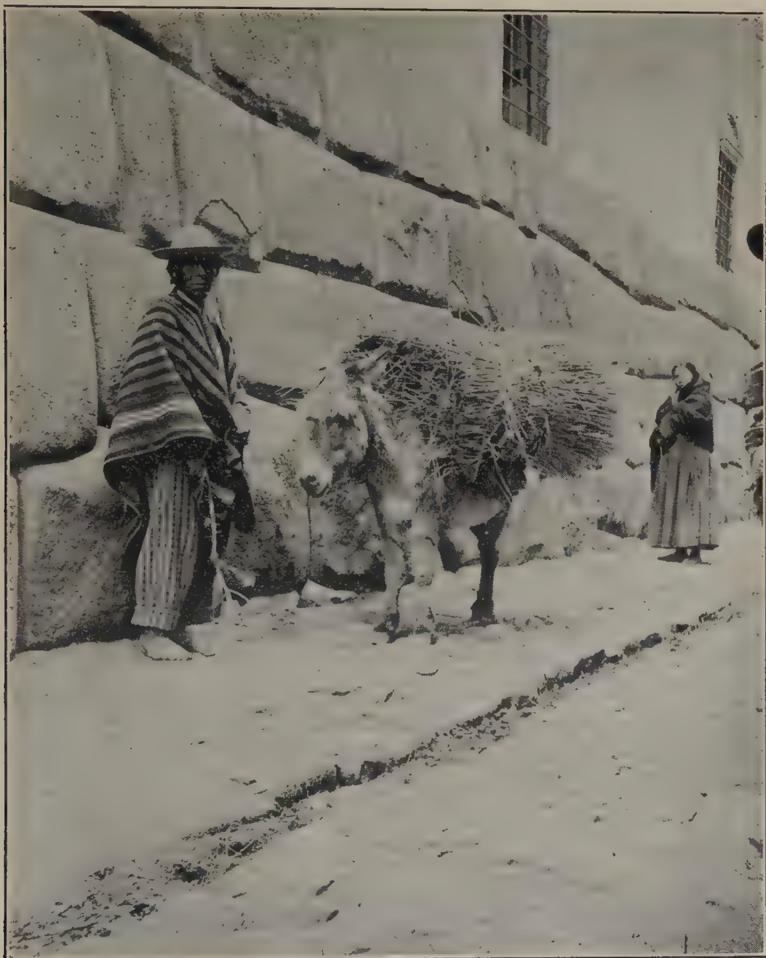

FIG. 16.
A common means of conveyance in Bolivia and Peru. Taken at Cuzco, 1907. Donkey loaded with straw used for fuel.

leaves of the cactus or that squeezed from large pulpy water potatoes.

The trade of the region is similar to that of the northerly regions of the Yungas and the Beni, with the addition of a greater amount

of hides, chocolate, and cinchona bark, and some products not produced farther north, such as sugar, rice, etc. The carrying has always been done more generally by ox carts than by mules. These are great, lumbering, uncertain vehicles, inexpressively slow, which follow not roads, but mere tracks 2 to 3 yards wide. While the superior navigability of the tributaries of the Mamoré has drawn much trade to the Amazon, some commerce persists toward the east and south. Even some rubber is shipped south from the Chiquitos and Mojos plains to Santa Cruz, to be taken by a one to two or more months' ox-cart journey of 400 miles to Corumbá, on the Paraguay. The return merchandise is of the general sort, already described, for the Chaparé. Insects, tigers and disease reduce the draught animals on the route and delay shipments. Rubber cargoes, following the loss of the draught animals, have in some instances lain two years beside the road awaiting shipment. Minchin states* that in the early '80's the rate from Santa Cruz to Corumbá, 400 miles,† was £43 per ton; from Santa Cruz to Cochabamba, 250 miles, or Sucre, 200 miles, £32; Santa Cruz to Jujuy (Argentina), 570 miles, £38 8s.; and from Buenos Aires to Corumbá, 1,500-1,600 miles (by steamer), £5 12s. What the Madeira falls have meant in money and toil to the traffic of the southwestern portion of the Amazon basin the unnavigable streams of southeastern Bolivia have meant, in an equal degree, to that section.

The increase in the cost of articles, conditioned by the mere transportation of them, is illustrated by the salt imported to the cattle farms at Trinidad and Villa Bella from the plateau of Bolivia. On the salars of the great central basin, the alti-plano, it is extremely cheap in its natural condition, in most cases absolutely free. Llama caravans convey it to Cochabamba, where it is shipped by mule caravan to Santa Rosa, at the head of navigation. Its cost on the plateau is, let us say, nothing, at Santa Rosa it is 15 cents gold per pound, and at Trinidad, a two weeks' journey below Santa Rosa, it is 30 cents gold per pound! The article is not only high-priced, but the cost is wholly due to the transport labor expended on it. High as is the cost of this commodity it is indispensable, not only to man, but to his beasts. The craving of tropical peoples for salt may be compared to that of temperate peoples for sugar, and in both cases is satisfied by the transportation of these products on a large scale

* *Ante*, p. 411.

† Distances here again are approximate, and are taken from Franz Germann's Mapa de la Republica de Bolivia, 1904; and from Andree's Allgemeiner Handatlas, 1904. They are more or less direct and if taken along the curves of the trail would be from 10 to 25 per cent. longer.

and often for great distances, even if primitive means are the only ones provided. Thus at the oasis of Taudeni, in the Sahara, 350 miles north-northwest of Timbuctu, are certain famous mines which produce great quantities of salt, that is shipped to the Niger valley, the cost increasing with every mile of the journey southward, and the same is true of the salt conveyed from the northern Sahara over the old caravan road from Tafilet. Lawes* mentions the same great craving for salt on the part of the natives of New Guinea, and numerous other instances might be cited from tropical lands where the great moisture prevents the accumulation of salt deposits.

The railroad development of the Gran Chaco region had its beginning in the extension of the Argentine lines to Corrientes on the Paraguay. In 1907 work was begun to extend this line up river toward Corumbá, while at Corumbá itself the line is being surveyed westward. The construction of this road has undoubtedly been stimulated by the coöperation of the American-Canadian syndicate, in connection with the São Paulo-Rio Grande railway in Brazil. Aside from the main lines near the coast or in the coastal provinces, there will be an extension 600 miles long into the interior of the country to Iguassú Falls, starting from the port of San Francisco. This line will open up Paraguay to the Atlantic by rail and by means of the Paraguayan railways, now existing or under concession, will connect with the new Bolivian railways ultimately to extend to Sucre, Santa Cruz and the Paraguay River at Corumbá. The considerations applied to the trade routes of the headwaters of the Madeira apply with only slightly diminished force to the southeastern route. The utilization of the water power of the mountainous border of the tableland and the stimulation of production afforded by improved transportation methods will mean the creation of new population groups and the rebirth of the old ones in the extensive and potentially wealthy grass lands of Chiquitos and adjacent provinces and in the fertile Andine valleys bordering them on the west. The completion of any one of these lines to the east, to Cochabamba or Sucre and the plains, would seem to be the most compelling project in Bolivia's entire plan for development. The enduring riches of that country—the fertile soil, the rainfall, the abundant pastures of her eastern basins, valleys and plains—these are in great measure shut off from the tableland above. This great trans-montane area has every favorable quality which the

* An Excursion in the Interior of New Guinea; W. G. Lawes, Proc. Royal Geog. Soc., vol. 15, 1883, p. 357.

plateau lacks, except its vernal climate; and the equalization of upland and lowland products, now carried on under extremest difficulties, would, through a railway, become easy and complete.

Sugar and rice would then come, not from the United States and Germany, but from Santa Cruz, where some quantities are now derived. Wood, the great lack of the alti-plano, both for fuel and lumber, would be in great measure accessible; and the products of the flocks and herds of the plains, now as sadly wasted on the plains as they are needed on the plateau, would find a ready market, to the great encouragement of the grazing industry. And the limits of that industry are only to be expressed in terms of the well-nigh boundless plains that would support it. For this southwestern section of Bolivia the greatest promise lies in such a railway from Corumbá to Santa Cruz. The greater width of the eastern Andes, in the latitude of Santa Cruz, excludes this city and region from early participation in the plateau railroad scheme. Its natural riches, however, make it one of the most promising portions of Bolivia. Both Minchin and Church, the two best authorities on the region, have recorded their enthusiastic belief in its bright future. Certainly every fact of its development at the present time points toward the confirmation of their results. In spite of the greatest difficulties, the region continues to grow, and to-day fairly demands an outlet to the Paraguay. A comparison of costs, labor supply and healthfulness with the Amazon route would favor Santa Cruz for shipments from the whole Chiquitos province. Its position at the northern end of the Gran Chaco gives it a climate which compares favorably with that of the plateau. It would be unthinkable that, so fortunately situated with reference to climatic belts, the Paraguay and the Atlantic, it would yet find an outlet to the Pacific over a trans-Andine railway. Steamers of 9-foot draught can now go to Asuncion and boats of 3-foot draught can reach Corumbá, 2,000 miles from Buenos Aires.*

Railroads of the Bolivian Tableland

The center of interest and of actual construction of strictly Bolivian railways is the plateau section between La Paz† and Oruro. The Bolivian government has contracted with the Speyer syndicate, of which Grace & Co. are the purchasing agents, and the National City Bank of New York the financial agents, to spend the $10,000,-

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* *Ante*, p. 156.

† It would be more correct to say Viachi—the station a few miles out of La Paz on the La Paz-Mollendo line, which is the terminus of the Oruro line.

000 paid to it by Brazil in the building of over 300 miles of railway to cost $27,766,000. The difference between these two figures is to be covered by bonds upon the railways themselves. Half of the 300 miles is the line between La Paz (Viachi) and Oruro. The rest consists of branch lines to Cochabama, Sucre, Tupiza and Potosi. The Tupiza section will form a connection with the Argentine lines, the Cochabamba section will be an extension toward the plains, while serving the interests of one of Bolivia's four largest cities, and the Potosi line will eventually be extended to Sucre, which lies in much the same relation to the northern Gran Chaco as Cochabamba does to the Yungas territory. From Sucre

FIG. 17.

Drove of llamas loaded with Oregon flour starting on a two week's journey from Challapata to Sucre, Bolivia.

the natural continuation to Santa Cruz, thence across the Gran Chaco, via San José and the present ox-cart track, to Corumbá, the northernmost camp of the Brazilian lines, extended to and beyond Paraguay from the Brazilian coast at San Francisco. These lines have been "located" as far as Tupiza, Cochabamba and Potosi, and grading has been completed over the basin portion of the Potosi line, and for 30-40 kilometres from Oruro toward Cochabamba.

The immediate service of this important connection is apparent from a glance at the map of Bolivia. The two existing lines to

Bolivia are from coast ports 600 miles apart, while the land termini are 150 miles apart. Now 150 miles of land transport between the only two existing railways is an effectual bar to any system of partial transport over both lines. A mine or a store, located upon one or the other of the lines, was subject, without redress, to the prevailingly high tariffs that have marked the operations of these lines. This has been the history of railroad after railroad in South America. Every one has been characterized by a single track from the coast. Without competing trans-continental routes, without competition or even the barest chance of it in the coast valleys or upon the plateau, rates but slightly lower than those upon cart transportation to the coast, or in the case of the more remote locations, all that the old and the created traffic would bear, could be charged with the full knowledge that they would be paid. A railroad under these circumstances has been more profitable* to exploit than the incredibly rich mines it served or the wealthy sugar and cotton plantations it in some cases revived and in others created. A single figure will suffice to illustrate the point; the cost of the Arequipa-Puno section of the Southern Railway in Peru, completed from Mollendo to Puno, on Lake Titicaca, in 1874, was 6,400,000 pounds sterling.† Improvements and extensions have, of course, been made. These and the repairs will raise that figure considerably. The dividends paid to stockholders in 1906-1907 on the account of the railway above are not available, but the general statement of the account of the Peruvian Corporation owning the railway is as follows:‡

The accounts of the Peruvian Corporation for the year ended June 30, 1908, show a profit of £263,203, after deducting the usual charges and interest on the debentures at the rate of £4 per cent. per annum. The board proposes to place £50,000 to reserve, making a total sum of £575,000 to the credit of that account; to make up the debenture interest for the year to the rate of £6 per cent. per annum (by payment of £2 per cent. additional interest on April 1st, 1909); to pay on Jan. 16th, 1909, a dividend of £1 10s. per cent. on the preference stock, amounting to £111,710; to write off £4,280 on colonization account and £2,269 in respect of income tax, and to set aside, as in previous years, £4,000 toward the insurance fund on the lake steamers. These provisions will absorb the above-mentioned profit of £263,203, and, in addition £17,056 from the balance of net revenue shown in the previous year's accounts.

The importation of American goods is assured by the building

* Many of the railways were financially embarrassed for the first years of their existence, but so far as known all have soon become singularly profitable undertakings.

† Railways in Peru. The Geog. Mag. (London), vol. 1, April, 1874, pp. 36-41.

‡ *South American Journal*, Dec. 5, 1908, p. 640.

of this connecting line, inasmuch as the purchasing agent is an American concern, better acquainted with the prices, qualities and conditions of shipment of American goods. Their business growth at Oruro and La Paz has been nothing short of phenomenal, and while this is owing in part to their importation of railway material, it is also to a marked degree owing to the prestige which the house has gained through its relation to the railway and the general business thus secured. It is doubtful if any event in recent years has meant so much for our trade with Bolivia as the construction of this short railway by an American concern, with its stimulating effect upon the American business house associated with it. Although the effect is by no means confined to construction supplies, yet it is most marked there. The influence of the American has extended to the other railways of Bolivia and Peru. The new rails used for replacement on the Southern Railway of Peru are made in Pittsburg; over a hundred new modern-type engines recently installed are from Philadelphia; the brass locks on the windows were made at Hartford, Conn.; the car wheels at Ramapo, New York; the ties were imported from Oregon. The list of other American articles one may see upon the docks at Guaqui and in the stores at La Paz are of equal interest. Breakfast foods from Battle Creek, Mich.; condensed milk and cream from the Middle West; tinned meats of every variety from Chicago; shoes, collars, underwear, etc., from New England. These are only a few among many and are a sufficient indication of the hold we are acquiring upon Bolivia's trade, notwithstanding the more general opinion that here, as elsewhere, our trade is languishing, an opinion too widely credited for Peru and Bolivia by virtue of its emphatic repetition. Our share in that trade is still too small, painfully small, but the significant fact is that it is growing. Another decade will see it well established there.

The next great railway improvement affecting the Bolivia Railway Co., through its facilitation of the rapidly growing imports over the Mollendo line, will be the all-rail route around Lake Titicaca. There are now two expensive trans-shipments, unthinkably difficult impediments when conditioned by a lake but 143 miles long. Not only will the commercial needs of the territory the railway serves demand this improvement; it will be strictly enforced upon the company by the competition afforded by the early completion of the shorter, all-land route from La Paz to the better harbor at Arica.

Conclusion

The general bearing of this brief study may be summarized as follows: Nearly 90 per cent. of the people and 100 per cent. of the railways are in the southwestern third of the Republic. The shortest land connection between the largest groups of people and a commercial highway is to the Pacific. In a land where labor is so extremely scarce as in Bolivia, and where tropical conditions in its lowlands will prevent dense populations for centuries, the essentials of a trade route are strategic, plateau locations and short routes to the sea coast. Once the coast is gained the principal point is won, for while it might at first sight seem much more advantageous to have down-valley connections with the Atlantic rather than trans-montane connection with the Pacific, the long water route around the Straits of Magellan in large steamers is, in fact, much better than a long and difficult eastern land haul by pack train and canoe and launch at ruinous rates, except on railways; and but little better if the railway is only an auxiliary to the launches and steamers upon the navigable streams. With the Panama Canal completed, Bolivia's ores, rubber, chocolate, wool, etc., will find an even cheaper and a very direct water route to this country, now rapidly increasing her share in the supply of Bolivian merchandise.* The superior silver ores and rubber pay export duty. The other articles in the list are exported duty free, unless exported in ingots, bars or in the form of coin.

The superior carrying capacity of the Pacific steamboat over batelon and canoe and the superior healthfulness of the sea route will for a long time outweigh the possibilities of traffic via the Amazon for the people of the plateau and even a portion of the adjacent plains of Bolivia. The service of the railway extensions to the plains has already been outlined, the essential fact being that the service is chiefly for the ultimate products of the plains dwellers

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*According to the figures published in the *Bull.* of the Int. Bureau of Am. Repub. for July, 1908 and 1909 (pp. 69 and 37 respectively), the total foreign trade of Bolivia in 1906 was $45,347,000; in 1908, $33,837,000. The United States furnished 6.4 per cent. of Bolivia's imports for 1907, as against 5.6 per cent. in 1906 and 14 per cent. in 1908, Germany leading with 16 per cent. We took 0.32 per cent. of her exports in 1906 as against 0.13 per cent. in 1905. The exports by articles for 1907 are as follows:

Tin	$18,000,000
Rubber	5,300,000
Silver bullion and ore	2,375,000
Copper	1,650,000
Bismuth	575,000
Gold	18,000
Sundries, antimony, lead, etc.	250,000

and for the equalization of the needs of the plateau groups and the plains groups of peoples. Railways would accomplish miraculous changes upon these plains and would serve to encourage the growing of products which depend absolutely upon rail transportation, but for neither the present products nor the population are such

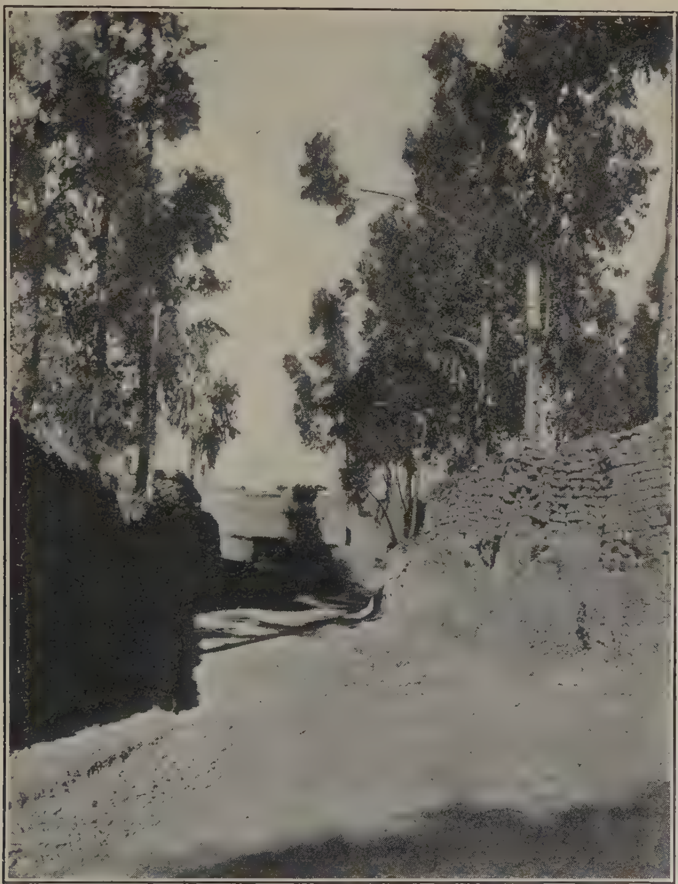

FIG. 18.

An old road at Sacaba near Cochabamba, Bolivia. The road has been used for centuries and with constant wear has been sunk four or five feet below its original level. The trees and original mud walls are perched high up at the old level.

railways indispensable. The rubber and the chocolate alone, gathered from a thousand scattered sources, do not require, in fact could not themselves support, any safer or speedier facilities than improved launches and wagon roads and short connecting railways

would afford. And they are, by all odds, the chief source of extra-territorial shipments. The goods for the numerous highland towns and peoples on the other hand require swifter shipments, have greater bulk, more concentrated sources of tonnage, and the heaviest shipments are the exports, the down-grade consignments of mineral products to the Pacific Coast. Furthermore, the navigable waterways of Bolivia* already serve much of the plains region, and, in general, serve it fairly well, except at locations similar to those of the Madeira rapids. The plateau and mountain section, in which Bolivia's mineral wealth lies, and where, on account of favorable climate and nearness to mineral resources and the sea, her densest population will long reside, has practically no navigable waters (Lake Titicaca and a portion of the Desaguadero only) and these are interior basin waters, they do not reach the sea. In the one case railways are an improvement, in the other a necessity.

A number of convergent factors operate to-day to hold trade to the old routes to the Pacific. The directive momentum of the railways, themselves an absolute essential in the mineral development of the plateau near the Pacific, are a powerful cause. Ores could never have been handled over the rivers of a tropical jungle. The dangers of travel through a steaming lowland can only become of lesser importance when the exact nature of these dangers is definitely ascertained and tropical diseases prove more generally curable than they are to-day. Furthermore, the population of South America is notably absent from the hot lowlands of Amazonia. Laborers in sufficient quantity for the transport of goods on the navigable rivers of the Amazon basin are conspicuously absent. That defect is, in fact, fundamental to any scheme for the development of Amazonia. There are tributaries of the Negro in northern Brazil, in whose basins rubber trees have been discovered in abundance, but whose resources can not be developed because of the almost absolutely unpopulated conditions of large portions of these basins. Church† was right when he ridiculed the Pacific route for goods destined for Cochabamba and Sucre and Santa Cruz from the single standpoint of mere cost to the merchant and the consumer; but it is not the viewpoint of the merchants in these places, but rather that of the carrier, that must be considered. Lacking carriers on the plains, merchants can only secure carriers

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* Bolivia's navigable waters total about 12,000 miles, and are almost wholly in the plains section; her wagon roads about 2,000 miles, between the largest towns; railways now actually in operation, over 400 miles.

† The Route to Bolivia via the River Amazon; G. E. Church, 1877, p. 150 et al.

from the plateau; and the plateau dweller, accustomed to aridity, and a healthful climate, has in all the history of South America and Mexico, dreaded the lowlands as he dreads the plague.* These factors are the most intangible and at the same time most potent of all and, therefore, the hardest to estimate. They have been totally overlooked by many writers who are concerned merely with distances and theoretic costs or costs based upon slight movement of goods in a region where, on account of a thin population, any increase of traffic would mean not only a doubling, but a trebling of existing rates. Were the eastern waterways of Bolivia opened to-morrow where would come the labor for operating canoes and batelons? Every student of the region knows how persistently the excuse "Es falta canoas" would be heard to-morrow as to-day, and how much more if traffic sought this route in any considerable quantity. Steam launches would improve conditions, and operating in conjunction with the railway now building about the falls of the Madeira might revolutionize traffic conditions. The difficulties of disease would still be present, however, and to this we must add the great expense for initial construction and upkeep of roads through the precipitous and rainy eastern Andes from the head of navigation to the plateau cities of Cochamba and La Paz. Most of the roads to the western seacoast are *per contra* notoriously good as to road-bed and grade. Comparatively little dissection marks the latter region; the former region possesses some of the profoundest descents and difficult trails it is possible to find.

As contrasted with the Atlantic route, the route west to the Pacific seaboard was in pre-railway days at a certain disadvantage. The Atlantic route had canoe service that was cheaper than the cart service of the western desert mountains and plains. The proximity of the Pacific and the healthfulness of the desert route undoubtedly held traffic to the more arduous way. No one can over-estimate the heat and disease of a flat tropical lowland as factors in keeping traffic to a more difficult and expensive, but less dangerous route. Costa Rica's experiences in this regard are instructive. Early in the 19th century the short, inexpensive, directer way from the relatively dry and more densely inhabited western section (in the lee of the mountains which here intercept the rain-bearing northeast trades) across the central mountains and the tropical lowlands of the east to the Atlantic seaboard was wholly

* Hans Gadow, Through Southern Mexico, and numerous other references relating to the Inca civilization, and the present trade routes of Tropical America, the plateau dwellers of Peru, Bolivia, and Mexico, etc.

untried and goods were then almost entirely forced to reach European markets by a voyage around Cape Horn! For a time the Saxapiqui route to the Atlantic was opened for tobacco shipments and European mail, but with the opening of the Panama Railway in 1855, the route "returned to its virgin solitude."*

These facts point to the conclusion that, in spite of the fact that 90 per cent. of Bolivia drains to the Atlantic and 10 per cent. is interior basin drainage with no outlet whatever to the Pacific, the section of the country in which the population is found yet looks toward the Pacific; and chiefly in this direction will she continue for many years to have relations with her commercial friends. Geographic position, the distribution of resources and climate are here equally powerful factors with topography and drainage, and, strange as it may seem, not only make, but will long continue to make the Atlantic slope, not the Pacific slope, the back door to Bolivia.

* Costa Rica; G. E. Church. *Geog. Journ.*, vol. 10, 1897. pp. 56-84.

THE ALPS DURING THE GLACIAL PERIOD*

BY

PROF. JAMES GEIKIE†

Among the most conspicuous evidences of formerly widespread ice-action in the Alpine Lands are the large travelled blocks or *erratics*, so lavishly scattered everywhere. From an early period these attracted the attention of intelligent travellers, some of whom expressed surprise when they saw that the isolated blocks did not consist of the same kind of rock as that of the mountains on which they rested. The numerous gigantic erratics—some as big as cottages—that strew the flanks of the Jura, looking towards the Alps, are often referred to as specially remarkable. Obviously these had been carried to where they are now found—but by what mysterious agency? Some—probably all—had come from the Alps,

* Die Alpen im Eiszeitalter. Von Albrecht Penck, Professor an der Univ. Berlin, u Eduard Brückner, Professor an d. Univ. Wien. In drei Bänden. Pp. 1199. Leipzig: Tauchnitz, 1909. Price 55 marks.

† This distinguished Scottish geologist wrote the review here printed of Penck and Brückner's great work upon the glaciation of the Alps. The paper appeared in the *Scottish Geographical Magazine*, pp. 481-91, 1909, and is reproduced in the *Bulletin* by its courtesy.

and had therefore travelled many miles. Amongst other vague conjectures it had been suggested that the transporting agent may have been water—that the blocks might have been swept down from the Alps by powerful débâcles or cataclysms. Such views, however, were considered unsatisfactory—a more reasonable explanation of the phenomenon had yet to be found. It is interesting to Scotsmen to know that the first to discover the solution of the problem—to divine the true origin of the erratics—was a fellow-countryman, John Playfair, formerly Professor of Natural Philosophy in the University of Edinburgh, and a devoted disciple of James Hutton, one of the greatest founders of the present system of Geology. During a visit to Switzerland in 1815, Playfair was much impressed with the great wandered blocks of the Jura. One of these—a mass of granite—he estimated to weight 2520 tons, and his sagacious reflections are worth quoting, inasmuch as his recognition of the glacial origin of the erratics of the Jura was in point of fact the first step taken to work out the history of the Ice Age. "When we consider," he remarks, "that the present point where the granite is to be found in its native place is at a distance of 70 miles, it will appear no easy matter to assign a conveyance by which this block could have performed such a journey over hills and valleys without considerable injury. A current of water, however powerful, could never have carried it up an acclivity, but would have deposited it in the first valley it came to, and would in a much less distance have rounded its angles, and given to it the shape so characteristic of stones subjected to the action of water. A glacier which fills up valleys in its course, and which conveys the rocks on its surface free from attrition, is the only agent we now see capable of transporting them to such a distance, without destroying that sharpness of the angles so distinctive of these masses."

Some fifteen years, however, were to elapse before the study of the glacial formations of the Alps began to be seriously attacked by scientific men. It is to Venetz, Charpentier, and L. Agassiz that we owe the first clear outline of the several phenomena which unite to prove beyond any question that the Alpine glaciers were formerly much more extensive. These early observers indeed may be truly said to have laid the foundations of glacial geology. During the many years that have passed since the results of their investigations were given to the world, hosts of geologists from every country have visited the Alpine lands and increased our knowledge of their

glaciation. But the next most notable advance was made when Morlot in 1854 and Heer in 1858 discovered that there had been more than one great extension of the glaciers. To these two investigators belongs the honor of having been the earliest to recognize the existence of certain accumulations which have come to be known as "interglacial" formations. Still later it was reserved for a Scotsman—Andrew Crombie Ramsay—to demonstrate that the great Alpine lakes occupy basins of glacial erosion. His views were for many years pertinaciously contested, but many of his opponents, who thought that he had greatly exaggerated glacial erosion, are to-day compelled to admit that glaciers are much more effective agents of erosion than Ramsay himself had suspected. In short, it is now maintained that the larger valleys of the Alps have been throughout widened and greatly deepened by glacial action, and that the present rock-basins, profound and capacious as they may be, are yet of subordinate importance—being relatively shallow depressions hollowed out in the bottoms of valleys already overdeepened by glacial scour and excavation.

Many other questions connected with the glacial history of the Alpine Lands have interested geologists since the appearance of Ramsay's paper, "On the glacial origin of certain lakes in Switzerland," but important as these are, it must be admitted that by the work of the earlier observers the fundamental conclusions of glacial geology had already been established. Shortly stated, these conclusions are as follows: (*a*) the former greater extension of the glaciers; (*b*) the periodical return of such extensive glaciation; and (*c*) the effective action of glacier-ice as a modifier of the earth's surface. Nearly thirty years ago Dr. Penck, in his well-known work on the glaciation of the German Alps, recognized that these conclusions summed up the chief results of glacial research hitherto obtained, and in his and Professor Brückner's recent great work —*Die Alpen in Eiszeitalter*—the same opinion is expressed with regard to the present position of glacial geology. It is needless to say, however, that the problems considered by the earlier observers have since their time been looked at from other points of view, and treated in a different manner, while many subsidiary problems of much interest and importance have been discussed. Only those who are conversant with the literature of the science can realize the great advances made within the past thirty or forty years. By the following of new lines of research and the employment of improved methods of investigation, our knowledge of the history

of the Ice Age of Europe has been in a manner revolutionized. And no researches of the kind have been more fruitful in results than those pursued in the Alpine Lands.

In the elaborate work by Penck and Brückner we have a complete and detailed summary of all that is at present known of the glacial phenomena of the Alps. They have themselves devoted many years to the study, during which they have explored, one may say, the entire chain from end to end. From time to time each has given some account of his labors and the views he has been led to hold as to the glacial history of the regions examined by him. In the masterly work before us these independent researches are combined, so as to form the most important contribution to glacial geology which has appeared for many years. It represents the labors of nearly a quarter of a century, carried on only during academic vacations, and largely if not entirely at the authors' own expense. This speaks volumes for the enthusiasm of these distinguished glacialists, and for their personal vigor—only men who are strong both mentally and bodily could have accomplished what they have done. The publication of their work has been spread over several years—the first part appearing in 1901, and the last at the close of 1908. The first volume is by Dr. Penck, and discusses the glacial phenomena of the northern "East Alps." In this volume the author summarizes the results obtained by his colleague in the Salzach district. The glaciation of the northern "West Alps" is discussed in the second volume, to which both authors contribute, while the third volume is devoted to the "South Alps" and the eastern slopes of the great chain, which are drained by the Mur, the Drave, and the Save, and is in like manner the work partly of Penck and partly of Brückner. The authors cover so wide an area and treat their subject in such detail that it is quite impossible in a magazine article to deal with their accounts of particular districts. We may, therefore, confine ourselves to a short and necessarily imperfect summary of some of the chief results obtained. These are set forth more or less fully by Professor Penck in the concluding chapters of Vol. III.

The Alpine glaciers of the Ice Age attained gigantic proportions as compared with their puny successors of to-day, but it must not be supposed that the mountain-land was ever so continuously covered with ice as is the case with Greenland. The ancient glaciers did not, like the vast Arctic glaciers, draw their supplies from one uninterrupted snowfield—each was fed from its own particular

névé-basin. Nevertheless neighboring glaciers were in many cases not so independent, so sharply separated from each other as in our day. Not infrequently they coalesced across what are now dividing watersheds. This was especially the case on the northern slopes of the chain, as in Switzerland, North Tyrol, and Upper Bavaria. In those regions the glaciers reached the low forelands, where they united to form a continuous ice-sheet. It was otherwise, however, with the glaciers that descended from the higher Alps towards the east and southwest. These were clearly separated from each other, and did not coalesce even upon the low grounds—indeed, many dropped their terminal moraines well within their mountain-valleys. The same to some extent was the case with the ice-flows that drained the southern flanks of the chain. Several of these, however, deployed upon the forelands—the glaciers that occupied the sites of the great lakes, Maggiore, Lugano, and Como, uniting outside of the mountain-valleys to form a continuous ice-covering. It would appear, therefore, that the middle section of the Alps, between Switzerland and Upper Bavaria on the one hand, and the region of the Italian lakes on the other, was the area of maximum glaciation. The elevated central part of that area was covered with continuous ice from which glaciers flowed north while others trended south. It is worthy of note, however, that the ice-shed separating those two sets of streams nowhere coincided with but lay north of the watershed. The same fact has been observed in connection with the glaciation of the Scandinavian Peninsula and the Scottish Highlands—in neither of those regions did the ice-shed of glacial times coincide with the watershed.

In general terms it may be said that the glaciers of the Ice Age were simply exaggerations of their present successors. The latter are fed from the same névé-basins as those from which the glaciers of the Ice Age drew their supplies. It would appear, moreover, that these basins were not as a rule more deeply filled in the Ice Age than they are now. The Alps above the existing snow-line, therefore, must have much the same appearance as in glacial times. If this be the case, then it would seem that the former vast development of glaciation was due not so much to increased precipitation of snow, as to a lower rate of ablation or melting. In other words, extreme glacial conditions were the immediate result of a general lowering of the temperature. It is further notable that the precipitation of glacial times bore a close relation to that of the present. The areas of maximum and minimum precipitation during the Ice

Age and in our own day are the same—the existing snow-line running approximately parallel to that of the glacial period, but at an average elevation of 1200 meters above it.

The general facies of the organic remains, met with here and there in the moraines and fluvio-glacial gravels of the period, are quite in keeping with these conditions. On the north side of the Alps the great confluent glaciers terminated in a dreary Tundra-like region, lying some 400 to 600 meters below the depressed snow-line. From the ice-front escaped numerous glacial streams which distributed broad sheets of shingle and gravel over the low fore-lands. During the short summer these gravel-flats would be traversed by a network of watercourses which in winter time would be mostly dried up. The foreland of the Alps would thus seem to have resembled the tracts extending outwards from the Vatnajökull in Iceland—a desolate region, yet sufficiently clothed with vegetation to tempt thither the mammoth, the woolly rhinoceros, and the reindeer. The conditions on the south side of the Alps were less forbidding. There the snow-line was higher, and forests extended up to a height of 800 to 1000 meters, so that many of the glaciers must have invaded the tree-covered areas, and it is even quite likely that trees may here and there have grown upon the moraine-covered glaciers themselves, just as is the case to-day in Alaska and the Himalaya.

The gravel-flats spreading out in front of the southern ice-flows were not so sterile as those on the opposite side of the mountains. In certain places, not liable to be flooded by the glacial waters, a somewhat rich molluscan fauna flourished. Forests, however, did not extend everywhere along the foot of the mountains—on the contrary, wide stretches of marsh and peat-bog covered considerable tracts, the pools in which nourished alpine diatoms. The great mammals that roamed the Tundras on the north side of the chain would seem not to have frequented the forest-lands of the south. The teeth of mammoth, which are not uncommon fossils in the northern gravel-beds, occur very rarely in the south—one specimen alone having been obtained—while remains of the reindeer have been met with only at Mentone on the west and in Carinthia on the east side of the Alps. Of the woolly rhinoceros no trace has occurred. It is further notable that the Arctic element, so conspicuous in the glacial fauna of the north, is not present in the south, where the fauna is characteristically alpine—chamois, ibex, alpine hare, and marmot having ranged far south in the peninsula. The

southern foreland of the Alps, therefore, must have resembled the south coast-lands of Alaska rather than the drearier wastes of Iceland. Towards the east and southwest extremities of the chain the larger glaciers must likewise have descended into forest-clad land. Many of the smaller ice-flows of those regions, however, were confined to the upper reaches of the mountain-valleys. The general aspect of middle Scandinavia probably reproduces not inaptly the conditions that characterized the two ends of the Alpine chain during glacial times—the summits of the Southwest Alps appearing then not unlike the present snowy heights in the interior of New Zealand.

The glacial and interglacial deposits of the Alpine Lands are wholly of Pleistocene or Quaternary age. Nowhere throughout the whole region have any passage-beds been discovered which might serve to link on the Pleistocene to the preceding Pleistocene period. Should such passage-beds exist they must lie buried under the enormously thick alluvial accumulations that cumber the valley of the Po.

During the Pleistocene or Quaternary period the Alps witnessed several remarkable climatic changes—epochs of extensive glaciation alternating with epochs of milder and even genial conditions, during which the glaciers retired to the inner recesses of the mountains. That such oscillations occurred has of course long been recognized, not only for the Alps, but for all the glaciated regions of Europe and North America. It is true that the evidence of those changes has now and again been called in question and attempts made to explain it away. For example, the occurrence of fossiliferous freshwater deposits interstratified with moraine accumulations, within the peripheral areas of the glaciated tracts of Northern Europe, has been accounted for by temporary advances and retreats of one and the same great *mer de glace*. And similar explanations have been given of the appearance of fossiliferous beds intercalated in the glacial deposits of North America. There are many phenomena, however, connected with those interglacial beds which the theory referred to does not and cannot account for. If the organic remains were always of such a character as to lead to the belief that the plants and animals they represent might have flourished in the immediate proximity of a great ice-sheet, there would be something to say for the theory in question. But so far is this from being the case that many interglacial deposits have yielded the remains of a fauna and flora strongly indicative of more genial

climatic conditions than now obtain in the same region. Not only so, but abundant evidence is forthcoming to show that interglacial epochs were of protracted duration;— in a word, the alternation of glacial and interglacial deposits points not to mere temporary advances and retreats of the glaciers but to secular climatic oscillations. The evidence adduced by MM. Penck and Brückner is so full and clear that it is impossible to misunderstand it. They recognize four distinct glacial epochs, separated the one from the other by more or less prolonged interglacial epochs. Each glacial stage is marked by a great series of moraines with their accompanying fluvio-glacial gravel-terraces. The interglacial stages, on the other hand, are distinguished by the presence of fossiliferous deposits, and by the evidence of long-continued and profound river erosion, of extensive sedimentation, and protracted atmospheric action. Not infrequently, when one series of moraines and moraine gravels has been superimposed directly upon another, the line of separation between the two series is nevertheless very marked— the older deposits having obviously been long exposed to "weathering," and even in many cases converted into hard rock-masses by the action of infiltrating water, before they were covered up by younger accumulations.

The several glacial epochs recognized by Penck and Brückner are named after localities where they are typically developed. Thus, beginning with the oldest, we have the Günz, the Mindel, the Riss, and the Würm epochs. During the first and last of these epochs the glaciation was less extensive than during the Mindel and the Riss epochs. It is remarkable that the Riss glaciers in certain valleys were larger than those which occupied the same valleys in the preceding Mindel epoch. In other valleys, however, the reverse was the case—the Mindel glaciers having attained a greater development than their successors in the Riss epoch. In the valleys of the Inn, the Salzach, and the Iller, for example, the Mindel glaciers were the greatest, but such was not the case with the Isar glacier, which was most extensive in the Riss epoch. So again in the Rhine region, in Switzerland, in the French Alps, and in the Po valley the Riss glaciation was the most extensive. It is thought that not unlikely these differences may have been the result of those differential crustal movements which are admitted to have affected the Alps during glacial times. If Switzerland experienced a movement of elevation in the interglacial epoch that followed the Mindel glaciation, the Riss glaciers in the West and Southwest

Alps would naturally attain larger dimensions than their predecessors of the earlier glacial epoch. Should subsequent research establish this conclusion, it would follow that the greatest depression of the snow-line must have taken place in the Mindel epoch—in other words, we should assign the maximum cold of the glacial period to the Mindel stage.

Although the phenomena of the great moraines and the fluvioglacial terraces of the Alpine forelands clearly shows that these tracts have experienced four successive glaciations, yet they do not tell us to what extent the glaciers retreated during the interglacial epochs. For such evidence we must turn to the fossiliferous interglacial deposits themselves, and they leave us in no doubt that the deglaciation was not less extensive than the glaciation. There were times when the glaciers retreated to the innermost recesses of the mountains, and the Alpine valleys experienced a warmer climate than the present. Among the most notable interglacial accumulations is the Höttinger Breccia, which occurs in the vicinity of Innsbrück. The rich flora obtained from this deposit has close affinities with a flora which flourishes to-day as far south as the southern coasts of the Black Sea. When the Pontic rhododendron and its associates flourished on the lofty mountain-slopes of the Inn Valley, the snow-line must have been some 400 meters at least higher than now. The climate, in short, could not have been less genial than that experienced at present upon the flanks of the Alps in Italy. There are certain contrasts between the interglacial floras of the northern and southern sides of the Alpine chain which are worth noting. The forests that clothed the mountain-slopes in the north were of the Baltic type, consisting mainly of conifers, oaks, maples, birches, and hazels. Along with these, however, were the yew, the box, the water-chestnut, etc., from the presence of which it may be inferred that the snow-line could not have been lower than it is to-day. On the south side of the Alps the flora had a marked Illyrian aspect: the chestnut flourished at a height of 800 meters, the vine grew, as it does to-day, along the banks of Lake Iseo, the box abounded, and the Pontic rhododendron (no longer an Alpine plant) was likewise very widely distributed. Nowhere was this interglacial flora associated with arctic-alpine types. The most notable animals of the time were extinct forms of elephant (not the mammoth) and rhinoceros (not the woolly species) and stag.

It would seem that the interglacial epochs were of unequal duration. This is indicated by the relative amount of geologlcal work

accomplished during the several epochs. Thus it would appear that the genial interval that separated the Mindel and the Riss glaciations, greatly exceeded in duration the earliest interglacial epoch—that namely which came between the Günz and the Mindel glaciations. This conclusion is based on the fact that much more geological work was done during the Mindel-Riss than during the Günz-Mindel interglacial epoch. Unless, therefore, we are to assume that during the former epoch the agents of geological change acted with much more energy than in earlier interglacial times, which is highly improbable, we must conclude that the second interglacial stages was the most prolonged. On like grounds MM. Penck and Brückner believe that the third or Riss-Würm interglacial epoch was considerably shorter than the earliest or Günz-Mindel epoch.

For various reasons it is more difficult to determine the relative duration of the cold or glacial epochs. The extent of their respective moraines and fluvio-glacial gravels might lead one to infer that the Riss epoch was longer than the Würm epoch. But there are so many other considerations to be kept in view that such inferences cannot be advanced with much confidence.

The passing away of excessive glacial conditions in the Alps is indicated by a succession of large moraines and associated river-gravels, which seem to show that the final retreat of the last great glaciers was interrupted by at least three long pauses or "Rückzugsstadien." The moraines in question are separated from one another by what are termed "interstadial" deposits, which resemble in character and position true interglacial accumulations. Our authors are very guarded in their interpretation of these phenomena, but are clearly of opinion that the moraines indicate successive advances of the glaciers, each advance having been preceded by a retreat of unknown extent. Named from places at which they are typically displayed, the three series (beginning with the oldest) are known as the Bühlstadium, the Gschnitzstadium, and the Daunstadium. From many observations we learn that during the earliest of these stadia the average height attained by the snow-line was 900 meters below its present level, while in the subsequent stadia it rose successively—reaching in the Gschnitzstadium a height of 600 meters below the existing snow-line, and in the Daunstadium rising some 300 meters higher.

The interstadial stages imply long periods of time during which the glaciers retired up their valleys for considerable, if indeterminate, distances. So far, therefore, they are comparable to the inter-

glacial epochs. In like manner, the moraines of the Bühl, Gschnitz, and Daun stadia are comparable to the similar moraines of the preceding glacial epochs, since each series of moraines, old and young alike, indicates a distinct readvance of the glaciers. The authors fully recognize all this, and are even willing to admit that certain interstadial accumulations may eventually come to be recognized as of interglacial importance. In general, however, the evidence is not decisive—the "interstadial" deposits are wanting in any clear indications of interglacial conditions. Their plant-remains have not yet been exhaustively studied, and until this work has been done it is considered safer to look upon the deposits in question as indicating less important climatic changes than the true interglacial accumulations. It is to be hoped, therefore, that the plant-bearing beds will ere long receive the careful attention of competent botanists.

Until we are better informed as to the extent of the climatic oscillations in Post-Würm times it will be impossible to correlate the last chapters of Alpine glacial history with the contemporaneous records of the Ice Age in other parts of Europe. One can hardly doubt that the climatic changes which took place in Northwest Europe in late glacial and so-called "postglacial" times, are the counterparts of those that marked the closing phases of the Quaternary period in the Alps. And if this should be the case, as seems in the highest degree probable, it would be advisable to drop the use of the term *postglacial* altogether. The word ought to have a definite meaning, and yet it is applied in different countries to deposits which are not of the same age. Properly speaking, there are no "postglacial" formations in the Alps. The deposits so named belong to Post-Würm times, and contain the records of the closing stages of the Pleistocene or Quaternary period. The minor fluctuations—the successive advances and retreats of the Alpine glaciers, as indicated by the "Ruckzugsstadien" and the interstadial deposits—may well have been of as pronounced a character as the climatic oscillations that took place in Northwest Europe towards the end of Pleistocene times.

At present the absolute duration of the Ice Age cannot be determined in the absence of an exact chronological basis, such as might be supplied by Astronomy. All the geologist can attempt to do is to ascertain the relative duration of the several epochs of the period. The amount of geological work accomplished during those epochs varied considerably, as we have seen. If it be not unreasonable to infer that the greatest amount of work required the longest time for

its accomplishment, then it would appear that the Riss epoch must be three times further removed from the present than the Würm epoch, while the Mindel may be twelve times older than the latter—the Günz being perhaps one and a half times as old as the Mindel epoch. On various grounds the Würm glaciation is conjectured to have reached its maximum rather than over 20,000 years ago. If this estimate be taken as some indication of the duration of the two last interglacial epochs, then the Riss-Würm interglacial epoch must have lasted for 60,000 years or thereabout, and the preceding Mindel-Riss epoch for not less than 240,000 years. Although such estimates do not pretend to be more than rough approximations, they nevertheless help one to realize how greatly extended are the periods of time embraced by glacial history. If indeed we keep in view merely the enormous amount of denudation and sedimentation accomplished during glacial times, we shall be prepared to admit that the inception of the Ice Age may well date back for several hundred thousand years. The Quaternary deposits occupying the great valley of the Po have been derived from the tear and wear of the Alps, and attain a thickness so extraordinary that to supply all this material the rivers must have lowered their drainage areas by at least 100 meters. Those two rapid rivers, the Kandar and the Reuss, having succeeded in lowering their drainage area by one meter in 3000 to 4000 years, we can hardly assign a shorter period than 300,000 or 400,000 years for the denudation of the Southern Alps and the filling-up of the Po Valley by fluviatile action.

In glacial times an arctic-alpine fauna—including the mammoth, the woolly rhinoceros, and the reindeer—flourished on the north side of the Alps; subsequently it was replaced by an interglacial fauna, but after the latter had disappeared, the arctic-alpine forms returned. These faunas acquire a fresh interest when we learn that prehistoric man was associated with them. Human relics belonging to the Mousterian stage of culture occur along with the remains of the earliest arctic-alpine fauna, and bespeak the presence of man during the Riss glacial epoch. The same stage of culture persisted into the succeeding Riss-Würm epoch, when the arctic-alpine forms had retreated and an interglacial fauna had succeeded. How genial the conditions were at this stage is shown by the evidence derived from the recently discovered cave of Wildkirchli at a height of 1500 meters on the Ebenalp near Säntis. The mountains appear to have been clothed at that time with a thick vegetation, and the climate could

not have been less temperate, but was probably even more genial than the present. Mousterian man lived in caves high up on the mountain-slopes, where he followed the chase. The Riss-Würm interglacial epoch with its characteristic fauna passed away, to be succeeded by the Würm glacial epoch and the reappearance of the arctic-alpine fauna. The stage of culture had now advanced from the Mousterian to the Solutrian, and finally, in Post-Würm times, to the Magdalenian.

While the arctic-alpine fauna plays a most important rôle on the north side of the Alps, it is otherwise on the south side of the mountains. There a well-marked forest fauna flourished during both the Riss-Würm and the Mindel-Riss interglacial epochs. But in none of the southern interglacial beds have any traces of man yet been discovered. Should these eventually be met with we should expect to find the Mousterian types in the Riss-Würm, and the Chellean in the Mindel-Riss deposits.

An arctic-alpine fauna, as we have seen, is associated with the two younger glacial epochs, and a "warm" fauna with the two younger interglacial epochs. Whether the same was the case with the two older glacial epochs and the intervening Günz-Mindel interglacial epoch is not known. Fossils are of very rare occurrence in the older glacial accumulations, while deposits which can be with certainty assigned to the Günz-Mindel interglacial horizon have not yet been detected. All than can be asserted is that the latter epoch was of prolonged duration, but whether the climatic conditions were as genial as those of the later interglacial epochs we cannot tell. Not improbably the Günz glaciation may have witnessed the advent of the arctic-alpine fauna, while during the succeeding Günz-Mindel epoch the region may have been occupied by the characteristic interglacial fauna. Certain it is that the older and younger arctic-alpine faunas and the older and younger interglacial faunas which alternated with each other in the later stages of the period remained much the same throughout. Some notable changes, however, did occur. Thus the southern elephant (*E. meridionalis*) and the cave-bear, which played a conspicuous part in the earlier stages, either disappeared or were very sparingly present towards the close of the long cycle of climatic oscillations. And doubtless many modifications of the fauna may have taken place, of which no record has been preserved. Nevertheless when we reflect on the prolonged duration and the many pronounced climatic changes of the glacial period—inducing as the latter must have done great migrations—

we may well be surprised that the faunas seem to have undergone so little modification. It was not quite the same, as we have seen, with our own race—for during the period man passed through all the successive stages of culture, from the very primitive Chellean to the relatively advanced Magdalenian type.

There are many other topics discussed in the 1190 pages of MM. Penck's and Brückner's treatise which we should like to have indicated, but space forbids. We shall have written to little purpose, however, if some notion of the general scope of the work cannot be gathered from our imperfect sketch. That our authors' results will have a strong influence on glacial research in other lands cannot be doubted. We shall now probably be spared the frequently reiterated statement that glacier-ice is a most ineffective eroding agent. Probably also the reality of the recurrence of alternating glacial and genial epochs throughout the Ice Age will no longer be so confidently disputed.

The book is well illustrated with numerous geological sections, maps, and photographs, and with the aid of these the reader should have no difficulty in following the descriptions and discussions of the text. It might have been well, however, if our authors could have seen their way to prepare a general map (preferably colored) to show the distribution of the glacial and fluvio-glacial deposits of the several epochs and stadia.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

MEETING OF THE SOCIETY. A regular meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday Evening Feb. 15, 1910.

President Huntington in the chair.

The following persons, recommended by the Council, were elected to Fellowship:

Samuel P. Avery,
Miss Rosa M. Batchelor,
Henry Goldman,
Countess Spottiswood Mackin,
Robert Brundrett.

The occasion was marked by the conferring of the Charles P. Daly Medal upon Colonel Charles Chaillé-Long. In the presentation of the medal, President Huntington said that the special service to geography by Colonel Chaillé-Long, which the Society thus desired to commemorate, was summed up in the inscription on the medal, which he read as follows:

"Awarded in MCMIX to Charles Chaillé-Long in recognition of valuable

additions to geographical knowledge made by him in Africa. In 1874 he explored the unknown Nile north of Urondogani, discovered Lake Ibrahim and supplied the final evidence needed to prove that the river issuing from Victoria Nyanza is the Nile."

In his remarks on receiving the medal Colonel Chaillé-Long said in part:

"Mr. President: I am deeply touched by your flattering allusions to my share in the final solution of the Nile Source problem. As the only American to attach his name to the discovery of the Nile sources, it was the idea of *pro patria America* which inspired and stirred me to the achievement for which you have awarded me this great honor. I accept this medal with profound thanks and appreciation of the honor it confers. The pleasure I experience is saddened by the absence of one who was an affectionate and devoted friend and advocate, your lamented librarian, the late George C. Hurlbut.

"Mr. President, on this occasion it is fitting to make honorable mention of the American military mission to Egypt, of which I was a member, and which added prestige and honor to the American name in Egypt and Africa. The mission was semi-official, inspired by Gen. Sherman when General-in-Chief of the United States Army. It was composed of Federal and Confederate officers, ten of the former being officers actually in the United States Army detached on a year's leave of absence. Its purpose was partly scientific and it was employed by the progressive Ismail Khedive in scientific objects, among which was the final discovery of the Nile sources.

"It was an American who designated Tel-el-kebir as a defense against a threatened Turkish invasion; an American who made the preliminary hydrographic studies in 1870 which became the inspiration of the dam at Assouan a generation later; an American who, charged with the coast defenses of Egypt, constructed a counterpoise disappearing battery, which has since been adopted by the United States Government; an American who made a treaty with Uganda adding that country to Egypt, and navigating the unknown Victoria Nile, discovered lake Ibrahim, thus completing the work of Speke and Baker; an American who, having pushed the limits of Gordon's government south, extended it westward towards the Atlantic and eastward to the Indian Ocean to Kismayu and Mombasa. The latter port has since served as a point of penetration of the railroad from Mombasa to Uganda; an American who discovered the Wadi Raiyan, for which he holds the control. It would add another reservoir whose drainage capacity this year alone would have saved fifteen per cent. of the cotton crop. Used as a reservoir, it would double the summer supply of the Nile Beni-Zoef; Americans, finally, of the United States navy and marine corps, in 1882, saved thousands of lives, including those of the Khedive and family, and saved the city of Alexandria, the great seaport of Northeastern Africa, from entire destruction in 1882.

"Mr. President, I would add a tribute to my chief, the late General Charles Gordon, with whom I had the honor to serve as Chief of Staff, and who promptly recognized my share in the solution of geographical problems.

"Gordon was an officer of the Royal Engineers of the British Army. Had Gordon not been an Englishman he would have been an American. He has been misunderstood and misrepresented by his own countrymen. I had myself misunderstood some of his methods which seemed to me at the time illogical, but I gave to him during my service of three years, absolute devotion to the attainment of his object. I have never subscribed to the attribution to him of what Burton

called excessive "religiosity." I believed, on the contrary, that he was actuated rather by all the legitimate aspirations of a soldier; in a word, he was more soldier than saint.

Mr. President, I renew my thanks for and appreciation of the great honor this Society has conferred upon me, and to cite a line from Horace: "Alboque dies notanda lapillo"—this day is marked by me with a white stone.

President Huntington then introduced the speaker of the evening, Professor James H. Brewster of the University of Michigan, who addressed the Society on "From Bahia to Buenos Aires." Stereopticon views were shown.

The Society then adjourned.

NORTH AMERICA

Sales of the U. S. Geological Survey Maps. Last year the Survey sold 475,636 topographic maps and 15,556 geologic folios. Formerly these folios were published only in folio form, but owing to the demand for a smaller size, the Survey has recently adopted an octavo or pocket form and will hereafter publish all folios in both forms. The octavo or book form will slip readily into a large coat pocket, and its price is 50 cents or double that of the folio, though in orders of $5. or more the price of the book is 30 cents.

Government Irrigation Work in the West. In the *National Geographic Magazine* (Vol. 20, pp. 403-37, 1909), Mr. C. J. Blanchard, of the United States Reclamation Service, under the title, "The Call of the West," gives a graphic account of the work which has been and is being done by the Government in irrigating the arid West. Irrigation is, fundamentally, a climatic problem. Given sufficient rainfall, properly distributed throughout the year, and irrigation is unnecessary. Given a rainfall too small for purposes of agriculture, or a rainfall irregularly or unsatisfactorily distributed through the year, and irrigation becomes essential. Thus, all irrigation undertakings are inevitably of interest to climatologists. Mr. Blanchard makes an estimate, which he considers "conservative," that 30,000,000 acres of land will be reclaimed in the arid West. He gives an account of all the Government irrigation projects, with an abundance of illustrations showing the condition of the country before and after the water was supplied. There is also a useful sketch-map on which the location of the reclamation projects is shown. Up to January 1, 1909, the Reclamation Service has built more than 3,458 miles of canals and ditches, which, if placed end to end, would reach from New York to San Francisco. It has built 338 miles of roads, most of them in a country heretofore inaccessible. Nearly 1,000,000 acres are now ready for irrigation, embracing 4,686 farms. As a result of the activities of this Service, more than 20,000 people are now established in homes in the arid West.

R. DeC. Ward.

SOUTH AMERICA

Dr. Wilhelm Sievers' latest travels in South America. The results of Dr. Sievers' studies of the geography of the northern cordillera of South America and of their former and present glaciation have long been before the public. Means were provided in Germany for the renewal of his work, last year. He reached Buenos Aires on March 20 and left the continent at Guayaquil on Oct. 29, having spent six months in extensive journeys among the mountains of Peru and Ecuador. He collected a large amount of new material, especially relating to

glacial phenomena, and considerable of it in virgin territory. Dr. Sievers has published an itinerary with a map of his routes in *Petermanns Mitteilungen* (Vol. 56, p. 24). The publication of his latest results will be awaited with interest.

Standard Time for Chile. Some two years ago, Peru adopted, as standard time, the 75th meridian west of Greenwich, which cuts the republic into nearly equal eastern and western parts. Chile has now followed Peru's example, though the 75th meridian lies to the west of the republic, excepting where it cuts the Peninsula of Taytao in the Province of Chiloé and some of the islands of the Magallanes Territory. This fact, however, will not interfere with the practical convenience of the new time standard, as Chile will have the same time as Peru and the eastern part of the United States, or in other words, five hours later than Greenwich time.

AFRICA

Gold Output of the Transvaal. The Transvaal colony made a new record in gold production, in the fiscal year, July, 1908-June, 1909. The tables given in the *Annual Report* of the Government Mining Engineer, for the year ending June 30, 1909, show that the total value of gold mined was $154,929,830. The Witwatersrand produced $149,484,130 of this amount. The Transvaal has thus again produced not only a far greater quantity of gold than any other country, but its output for the year was about 34 per cent. of the product of the world. The colony's coal industry is also growing, the output having been 3,312,413 short tons. The number of men employed in the Transvaal mining industries was 21,720 whites, 12,206 Chinese and 189,200 blacks.

From Haussa Land to Egypt through the Sudan. Dr. Karl Kumm has made a preliminary report, with a map of his route, on his journey eastward throug the Sudan in 1908-9 (*Pet. Mitt.*, Vol. 56, p. 84, 1910). In the course of this journey he traversed three hitherto unexplored districts and visited about 70 towns and settlements not previously mapped. The first of these districts was in Northern Nigeria in the southern part of the Bautschi Mts., where he discovered several new mountain ranges; the second new region was in the French Shari territory on the lower course of the Bahr Salamaat and Bahr Auk; and the third was between Fort Archambault on the Shari river and Keffi Genji on the Bahr el Ghazal, a large territory embracing the regions Sinussi Ndele in Dar Kuti, Dar Banda and the watershed between the Nile-Congo and the Shari. Among his zoological discoveries were a new variety of the giraffe with three horns, the two in the rear being joined at the base, and a variety of the Buffalo with remarkably flat horns. He finally reached the Anglo-Egyptian province of the Bahr el Ghazal, with 200 half starved people, and arrived at Khartum on Dec. 3 last.

Through Uganda and the Mountains of the Moon. The lecture of Prof. Charles E. Fay, of Tufts College, before the Society on Dec. 21, with its accompaniment of superb lantern slides from the negatives of Vittorio Sella, afforded the opportunity to follow step by step the expedition of the Duke of the Abruzzi to the glacial sources of the Nile on the lofty summits of Ruwenzori in Equatorial Africa.

In his introduction, the lecturer gave a rapid sketch of this most versatile explorer, whose quests have been by sea and land, in the arctic ice and under the sun of the Equator, to the summit of Mt. Saint Elias, and, most recently, to the

highest point of our globe ascended by man, to 24,400 feet, on Bride Peak in the Himalaya of Cashmere.

Starting from the port of Mombasa, of which a few views were shown, the journey of some 560 miles to Victoria Nyanza,—from sea-level to an altitude, on the high plains of Athi of 8,500 feet, and then descending to 3,862 feet at Port Florence, was touched upon, a single snap-shot taken from the moving train showing the profusion of game that has rendered this region famous. A few striking views of the lake itself followed, with the canoes of the natives, and particularly a spirited view of Ripon Falls, at the point where the waters of this great inland sea débouche to form the Upper Nile.

Uganda was entered at Entebbe and several views presented the general appearance of the British capital and the homes of foreign residents, contrasted with those of the natives. The gathering of the little army of porters and other attendants (300 in number), small groups and individual types of these Baganda negroes, and their joyous departure under their loads of 50 lbs. each, strung out along the highway far as the eye could reach, opened the story and pictured scenes of the march across Uganda—the second stage of the journey of about 900 miles from the coast to the icy goal—the stage ending at Fort Portal, 220 miles from Entebbe, and lying at the base of the outliers of Ruwenzori, yet separated therefrom by the most difficult and toilsome part of the journey.

The road to Fort Portal, the seat of a Government Commissioner, is a well-kept highway over a country varied with hill and dale, with clearing, forest, and morass. Many views were shown illustrating the landscapes, and many representing the camps and camp-life of the Expedition. Of especial interest were those showing the wrestling, dancing and other entertainments furnished by the porters, and the home scenes of the inhabitants,—groups of women bringing supplies, chiefs and their attendants bearing gifts of welcome, etc.

The first sight of the Ruwenzori range, seen high above the clouds and covering an angle of many degrees, at a distance of nearly 50 miles, was of great interest, as bringing within the range of vision the phenomena of all the zones—a view of arctic conditions from the belt of the Equator. Interesting again from the fact that when the view was taken, it was a picture of the unknown, all its detail enigmatical; yet a few weeks later, at the farewell view of the Expedition, the mystery had vanished, the summits had all been ascended and named, and the whole hydrographic system of the upper streams of the Nile that drain into Lakes Albert and Albert Edward had been surveyed from those snowy points of vantage.

Beyond Fort Portal, came the increased interest of the more difficult way, with its steep, densely wooded hills, its streams to be forded, and the intricate jungle of strange shrubs and trees, growing out of swampy earth, in which, by reason of the absence of changes of wet and dry, the fallen trunks retained their solidity almost intact, while in the moist air, thick moss enlarged to dropsical proportions the limbs of the gigantic trees of the region. Fine pictures were presented of this unique flora; especially beautiful was a green-tinted picture of the *lobelia Stuhlmanni* in full blossom.

A permanent camp was reached at a chilly, rain-frequented locality called Bujongolo, 12,460 feet above the sea, on June 6. From this point the first ascent of a peak of Mt. Baker was made, the first of a series of uniformly successful climbs. This camp was in the Mobuka valley to the southeast of the range, on

a stream whose waters eventually reach Lake Albert Edward (south of the entire range), which in turn empties by the Semliki river into Lake Albert to the north of Ruwenzori. A low pass to the west of the camp led over into the valley west of Mt. Baker, in the direct watershed of the Semliki. From this (later called "Freshfield Pass"), the ascent was made to the highest summit of Mt. Baker, to which the name of "King Edward Peak" was given. From this summit Sella afterwards secured a fine panorama of the nearby snowy giants which were severally shown upon the screen. The nearly complete topography of the range is comprehended in this panorama.

Ruwenzori—once usually spoken of as a mountain—was found to be a great complex of mountain masses, lying along the water parting, not of the Nile and the Congo, but of those waters of the Nile that flow eastward and those flowing more directly to the Semliki and so to Lake Albert. To these massifs the Duke gave the names of the principal explorers of the sources of the Nile; Stanley, Baker, Speki, Gessi, Emin, and to the southernmost he applied the name of Thomson. At the urgent request of the Royal Geographical Society, he later consented that the name Luigi di Savoia should be substituted for Thomson. Upon each massif rise several individual summits, to which separate names have been given. Mt. Stanley has five of these, to the two highest of which the names of the dowager queen of Italy and the queen of England were given by the prince on the occasion of his first ascent. Margherita attains 16,815 feet; Alexandra, 16,749.

The lecturer read from the manuscript of the lecture given by Sella in Turin before an immense concourse including members of the royal family, the Duke's own account of this culminating success of his expedition, as he conveyed the news by a letter dispatched through a messenger to the members of the party at the more distant camp. Views taken during the ascent of the highest peaks were shown as the vivid narrative from the explorer's own lips proceeded, a story thrilling with the spirit of adventure and the most ardent patriotism.

Remaining five weeks in the region, the Duke personally ascended thirteen of the eighteen summits of the several massifs, omitting only three of the less difficult and rewarding. Careful measurements were made of the peaks, nine of which exceed the altitude of Mont Blanc, and the topography and hydrography were carefully studied and have since been mapped.

ASIA

Mr. Douglas Carruthers' Journey in North-Western Arabia. This naturalist made a journey, last year, in Arabia, starting from Jesi on the Hedjaz R. R., 22 miles east of the Dead Sea, travelling about 350 miles south-west, to the oasis of Teima and returning by routes partly east and partly west of his southern march. He describes his journey in the *Geographical Journal* (Vol. 35, pp. 225-45, with map).

He traversed a region that was practically unknown for most of the way and his narrative gives very interesting descriptions of the nomads and of the different phases of the country. His starting point, Jesi, is the limit of cultivation for all is desert to the east of it. He first visited the Belka, the headquarters of the Beni Sakhr, a Beduin people who derive their strength and wealth from this transition country where they have good pasturage for their large herds of camels and flocks of sheep and goats. They are the boldest of robbers and possess many

rifles but their sheikh proved a good friend. They were living in about 1,000 tents scattered along the wadis. True nomads, for they do not cultivate, they range over the country to the east, falling back, from time to time upon their base.

Carruthers went with them as they sought new pastures. The camel provides them with meat, milk, clothing, tents and transport. They spend their lives in stock-breeding and systematic robbery. Now and then, the Beduins will go on a foray to steal camels and so increase their herds. They want rifles, which means power and with stolen camels, they buy more rifles. They buy wives with camels which, in fact, are their only means of exchange. They think nothing of killing if anything is to be gained thereby. In Beduin warfare the camp itself is never molested and the men go off to fight knowing that their camps will not be pillaged.

After a few days' march, Carruthers and his small party left the Beni Sakhr. The limestone plateau soon merged into the black desert or "the desert of flints" as the nomads call it, almost level, sprinkled over with countless flints, with almost no animal life excepting a few birds and desert hares, without dew fall, 3,000 feet above sea level, cut up by many wadis that carry much water when sudden storms occur. Among the few birds was the ostrich, an interesting discovery, for no traveller except Palgrave has mentioned sighting them in Arabia. For six days, the camels had no water and very little to eat.

The most southern point reached was the oasis of Teima, the first town of importance in Northwestern Arabia. The oasis forms a large patch of vegetation in an absolutely sterile basin. The inhabitants were quite friendly but the governor, representing the Emir of Hail, ordered the explorer to leave and had his servants rob him of all his money. This ancient oasis has a wonderful water supply and its great well pit is famous all over Arabia. Ninety camels can draw water at the same time and the supply is carried to the extreme parts of the oasis by a system of irrigation canals. It is doubtless a strong spring of pure artesian water that the natives have chanced to tap. A great deal of water apparently flows across Arabia but it is deeply hidden in the sandstones. The oasis produces citrus and some other fruits and tobacco. Dates which grow to perfection, are the staple food. Much rock salt is collected. The people are of the purest Arab stock and very handsome. The oasis is growing and, with its great water supply, it should have enduring prosperity. The people are very suspicious of strangers, Turks as well as strangers.

Mr. Carruthers escaped to the north in the night and for some days skirted the western edge of the Nafud, a sand dune region whose west limits had not hitherto been defined. This region supports considerable vegetation and a tall grass called "knusi" is good camel feed. On the way north, he was captured by a raiding party of Beduins who would have stripped him of all his possessions if their chief had not been friendly with the Beni Sakhr tribe under whose protection he had set out. He found at the well called Bayer, on the line of the supposed ancient trade route between Egypt and Busra, the ruins of a large caravanserai in the midst of the sterile desert which indicates an ancient prosperity that has long since disappeared. The explorer says that the Beduin near the Hejaz railroad were opposed to the building of the line, chiefly because it would take away from them the blackmail they have always imposed upon pilgrim caravans in exchange for safe conduct through their territory.

POLAR

SUCCESS OF DR. CHARCOT'S ANTARCTIC EXPEDITION. Dr. Jean Charcot, in command of the French Antarctic Expedition, arrived at Punta Arenas, Chile, on his exploring vessel *Pourqui Pas* on February 11. From this point he sent the following cablegram to France which has been communicated to the Society.

"I believe I have been able to carry out the scientific programme which had been arranged for my expedition by the Academy of Sciences. On our first voyage into the unknown, after reaching West Antarctica, we steamed to the southwest, along the west coast of the mainland and continued the survey of the coast which we had begun in our former expedition. Grounding in shallow waters caused us considerable trouble but we completed the map as far as Adelaide Island, a remarkable bit of land about 81 miles in length. South of it we discovered a very large gulf, surveyed 120 miles of new coasts and finally reached Alexander I Land which was the chief goal of our enterprise. It was a most inhospitable region with an ice bound coast, great glaciers and icebergs and no shelter for our vessel.

"We therefore returned north and wintered at Petermann island. The winter temperature was comparatively moderate but the weather was extremely disagreeable and a number of our party were sick. Fortunately, all recovered. We made a number of interesting excursions and particularly on the glaciers.

"Our second campaign included studies in the South Shetland islands especially on Deception and Bridgman islands. Then we returned to the south, discovered new lands to the west and south of Alexander I Land, relocated Peter I island and sailed between the 69th and 71st parallels as far as 126° W. Long. We wished to accomplish more but we have done the best we could."

A little later information is that the party suffered to some extent from scurvy and the ship was damaged by collisions with icebergs. The motor sledges were impracticable on bad ice and the supply of food and coal was not adequate.

THE DUKE OF ORLEANS' ARCTIC CRUISE IN 1909. Between June and September, last year, the Duke of Orleans made his third Arctic voyage on the *Belgica.* He was accompanied by the Antarctic explorer, Capt. de Gerlache, Dr. Récamier and the painter Ed. Mérite. His journey extended from the east coast of Greenland to Franz Josef Land. While hunting was the main object, an important oceanographic result was obtained. The *Belgica* reached the east coast of Greenland at Cape Hold With Hope (73° 30′ N.), then pushed further north, doubling Wollaston Foreland and took to the open sea, eastward, in about 78° N. The Duke improved the opportunity to complete the soundings of 1905 on Belgica Bank and he was able to fix the edge of the Greenland continental shelf in those waters. He found the edge of the shelf at 1,145 feet, that is to say, at a greater depth than usual. Such depths at the edge of the continental shelf seem especially to mark lands that have recently been subjected to great glaciation. The interesting fact was also noted that the edge of the polar current on the east Greenland coast seems to coincide with the edge of the continental shelf. Both going and coming, the expedition traced the edge of the pack ice between Spitsbergen and Franz Josef Land and ascertained the amount of its recession during the summer. (*Annales de Géog.,* Vol. 19, p. 95.)

RASMUSSEN'S PROPOSED EXPEDITION. The *Geographical Journal* prints a short paper (Vol. 35, pp. 295-9) by Knud Rasmussen on his coming expedition, the

official name of which will be "The Danish Ethnographical Expedition to the Central Eskimo." He believes it to be all but settled that the Greenland Eskimo at Smith Sound include a number of families who are the last immigrants from the American Eskimo districts and that they came from the north-western part of Baffin Land or, in other words, between Bylot island and Fury and Hecla Strait. The Eskimo living there are among the least known of their race though the district they occupy is probably the thoroughfare from the continent to Greenland. He proposes to study these Eskimo and also their little known congeners in the Barren Lands of northern Canada, the northern coasts of Hudson Bay and westward along the northern sea coast to Coronation Gulf. He expects to start from Copenhagen on his ship, a small vessel of the Göa type, in the summer of 1911, and to make his first winter quarters in Fury and Hecla Strait where he will make his studies and sledge trips around and in North-western Baffin Land. Quarters for the second winter will be sought in Chesterfield Inlet, convenient for work among the inland Eskimo and those of the western coast of Hudson Bay; the third winter quarters are likely to be established in Repulse Bay at the neck of Melville Penisula and it is hoped to travel westward along the coast as far as the huts of the almost unknown Eskimo of Coronation Gulf. Besides the small crew, a geologist and a physician will be included in the party and it is hoped to do considerable scientific work outside the study of the Central Eskimo.

METEOROLOGY

THE ANTICYCLONIC BELT OF THE NORTHERN HEMISPHERE. In the *Quarterly Journal* of the Royal Meteorological Society (Vol. XXXV, No. 152, 1909), there is a paper by Col. H. E. Rawson, C. B., on "The Anticyclonic Belt of the Northern Hemisphere." In a previous communication, a few years ago, the author brought forward some facts relating to the anticyclonic belt of the southern hemisphere, derived from an examination of the South African records from the year 1841 to 1906. He found that the cyclical oscillations of the belt to and from the equator over South Africa were strong enough to encourage the belief that an analysis of Australian records on the one side, and of Argentine records on the other, would prove that all the action-centers of the atmosphere were moving together over this wide area, and that a similar oscillation existed in the northern hemisphere. Col Rawson subsequently found that the investigations of Mr. H. C. Russell and Dr. W. J. S. Lockyer supported his conclusion that there is a period of about 9.5 years between the greatest south position of the anticyclonic belt in the southern hemisphere, the double oscillation thus taking 19 years. He has since extended his inquiry into the movement of the action-centers in the northern hemisphere, with a view to ascertaining whether they show any similar oscillation to and from the equator, which is not to be explained by seasonal changes of position. Dealing with the Nile floods, he draws the inference that the high-pressure systems which affect northeast Africa are farther north when the floods are in excess, and nearer to Egypt when they are deficient. He has also made an analysis of the tracks of hurricanes which passed north and south of the Manila Observatory, and finds that these throw an interesting light upon the oscillations of the action-centers of the atmosphere. R. DEC. WARD.

PHYSICAL GEOGRAPHY

GLACIATION IN SOUTHERN CALIFORNIA. The recent announcement of former glaciers in the San Bernardino Range, California, is of much interest (H. W.

Fairbanks and E. P Carey, *Science,* N. S. Vol. XXXI, 1910, 32-33). This brings mountain glaciers as far south as the latitude of Atlanta, Ga. and Charleston, S. C. where previously they had not been known in the United States south of the Sierra Nevada and the San Francisco peaks in Arizona. There seems to have been at least five glaciers, evidenced by cirques, lakes, terminal moraines, etc. None of these glaciers descended below 8,500 feet. They owed their existence to high altitude and north or northeast slopes. LAWRENCE MARTIN.

PLEISTOCENE GEOLOGY OF THE LEADVILLE QUADRANGLE. The detailed study of mountain glaciers and glaciation in the United States has resulted in another strong contribution published by the U. S. Geological Survey (Pleistocene Geology of the Leadville Quadrangle by S. R. Capps, Jr. *Bull.* 386, U. S. Geol. Survey, 1909, pp. 1-96) Parts of the Park and Sawatch Ranges of Colorado have been mapped, including the basins of thirty-seven valley glaciers whose total area was 358 square miles. These glaciers were from two to twenty miles in length. They headed at from 13,700 to 12,000 feet above sea level and descended to from 10,300 to 8,800 feet.

Evidences of glacial erosion include striae, cirques, truncated spurs, U-shaped valleys, hanging valleys, etc. Lateral, terminal, and ground moraines were deposited The author finds small remnants of what he interprets as older drift, with which he associates the high terraces of the Arkansas valley. There are also low terrace gravels. The glacial changes of drainage are of no little interest. Post-glacial erosion is trivial. LAWRENCE MARTIN.

VARIOUS

GEOGRAPHICAL BIBLIOGRAPHY. The 18th volume of "Bibliographie Géographique Annuelle," for 1908, issued as a part of *Annales de Géographie,* contains 1,105 notices of geographical books and papers that were published in 1908. The plan is selective rather than exhaustive but practically all the best works are included. The distinctive feature is the analytical and critical notes that accompany nearly all the references. They are admirably done by the many authoritative writers who collaborate with Dr. Louis Raveneau, under whose direction the bibliography is published. These notes not only give a clear idea of the scope of each book and paper but often condense the more important information it contains so that the volume is not only a good bibliography but also a valuable work of geographical reference. This feature has given to the annual a place of its own and the Paris publishing house of Armand Colin is to be congratulated upon the high estimation in which the book is held.

THE RETURN OF HALLEY'S COMET. This comet will cross the plane of the ecliptic on May 18 when it will be almost exactly between the sun and the earth, and the earth will probably be in the tail of the comet. Astronomers say that a fine display may be expected. The tail will probably be 20 or 30 degrees in length. The comet will best be seen at the end of May and a better view of it is anticipated in the United States than in more northern latitudes. Its history has been traced back to 240 B. C. and most of its returns have been recorded. It is believed that, in no case, can this comet return to perihelion unseen and therefore some of its reappearances were not recorded or the records perished.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Trans-Himalaya. Discoveries and Adventures in Tibet. By Sven Hedin. 2 Vols. xxiii—436 pp. and xvii—439 pp., 388 Illustrations from Photographs, Water Color Sketches, and Drawings by the Author, 10 Maps and Index. The Macmillan Company, New York, 1909. $7.50.

The two volumes containing the account of Sven Hedin's last journey in Inner Asia deserve high praise and severe criticism. No one can read this account of a most daring journey in a fascinating land, without a feeling of genuine admiration for a man who had the pluck and determination to carry out so arduous an undertaking. Few travellers have ever displayed more skill in overcoming difficulties, and few have succeeded so well in winning the love and devotion of their followers. In all his journeys, Hedin's men have been faithful to him from first to last, a fact which speaks eloquently for the character of the brave Swedish explorer.

"Trans-Himalaya" is a book written for popular consumption. Starting from India, Hedin proposed to cross directly into Tibet. The British government, however, by reason of its recent agreement with China, felt obliged to forbid this. Therefore Hedin was forced to go northward from Ladakh into Chinese territory. There, in the dreary plateau of Karakorum, he swung to the east, and came into Tibet through the vast uninhabited wastes of the northwest. For seventy-nine days he and his faithful followers never once saw a human being other than their own companions. Day after day they marched over unending plains of gravel or snow at elevations of 16,000 or 17,000 feet, or over wearisome icy passes 19,000 feet above the sea. So great was the elevation that even in October the temperature fell to—17° and later it fell to—40°. Although a supply of grain was carried for the horses and mules, the poor beasts often had no forage. Little by little they grew weak and began to die, falling one by one at first, and later in twos or threes, to be devoured by rapacious wolves. Hedin describes his experiences vividly. The reader cannot fail to be impressed by his picturesque accounts of long toilsome marches when man and beast were half dead with cold, and of fierce storms which almost overwhelmed him when he put his folding boat on some of the many salt lakes of Tibet.

The purpose for which all these hardships were endured was the exploration of the large blank patch which has hitherto occupied the west central portion of maps of Tibet. Here Hedin crossed a great range of mountains, which was known at either end, but had never been explored for a space of 300 or 400 miles in the center. When, for the first time, he had crossed this Trans-Himalayan range, as he calls it, he came into the inhabited portion of Tibet. There, after many interesting experiences, he was turned back. The Tibetans firmly prevented his advance, but being mild people and not fond of violence, they yielded

to his incessant efforts, and permitted him to cross the Trans-Himalayas, once more, and then to come back again to Lake Manasarowar. There, near the sacred lake of the Hindus, he pushed his way to the sources of three great rivers, the Brahmaputra, the Sutlej, and the Indus, all rising close together. In the end, however, he was forced to leave Tibet and go back to Ladakh.

Most explorers would have been satisfied with what Hedin had accomplished, but having set himself a task, he pluckily kept at it. Without letting his men know what he planned, he equipped a new caravan in the extreme northeast of Ladakh, close to the limits of British authority. Then, in order to avoid all risk of being turned back by the authorities, he travelled far northward in midwinter along the baleful road over the Karakorum pass toward Khotan. When well beyond the danger of interference from any government, he turned eastward into the unknown plateau, and suddenly found himself face to face with the problem of how to feed his animals on nothing. His men, thinking that he was really going to Khotan, had disobeyed orders, and had not laid in the proper amount of grain. In spite of this Hedin kept on; and after sixty-four days without seeing human beings, his attenuated caravan arrived once more among the Tibetan nomads at the base of the Trans-Himalaya range. Here comes the most fascinating part of a highly interesting story—the tale of how Hedin assumed the disguise of a shepherd and for a while eluded the Tibetan officials. They soon grew suspicious, however, of a caravan which chose to travel in the worst of seasons on the worst of roads. When the disguise was thrown off, the explorer was once more forced to leave the country, but not until he had completed most of the exploration that he had planned. The chief result of Hedin's work is that he has proved that the Trans-Himalayas are a continuous range extending to almost as great a length as the Himalayas themselves. He has also mapped a considerable area of hitherto wholly unknown country. Future generations may not deem this so important a matter as Hedin would count it. Nor is it likely to be reckoned so great an achievement as his previous explorations in Chinese Turkestan. Nevertheless, as a piece of pioneer exploration, it is highly creditable and valuable.

Hedin's book, as we have indicated, is fascinating: in places it is positively thrilling: it is full of vivid descriptions of scenery and people; and it gives a clear idea of the aspect of one of the most unique parts of the world. Nevertheless, to the thoughtful reader, it is disappointing. As one reads on through the 900 pages of the two volumes a feeling of impatience comes over one. Why does not Hedin leave out some of the innumerable petty details about his horse, his puppy, his feelings, the man who happened to be his guide, the way his tent was pitched, and a score of other trivial matters? Instead of these, why not give us an occasional chapter, or at least a page or two of serious scientific descriptions? The quotation of a single paragraph will illustrate the way in which minor, and often personal details are continually repeated. On page 404 of volume I, we read:

"In Karu, wheat, barley, peas, and radishes are cultivated. We had made a short march, and I had ample time to interrogate the wise men of the village about the geography of the country, the means of communication, the climate, the habits of the river, and the directions of the wind; but I have no room for such particulars in this book. I would rather, instead, introduce our escort to the reader. [An escort, be it noted, that stayed with Hedin only a few days,

and has no importance to the reader unless it can be made to illustrate the habits and character of the people.] Vang Yi Tyn is a Dungan, born in Shigatse; Tso Tin Pang has a Chinese father and a Tibetan mother, has a home in Shigatse, holds the lamaistic faith, and murmurs prayers on the way; Lava Tashi and Shidar Pintso are pure Tibetans. All four are friendly and ready to help, and tell me in confidence that they mean to do their very best, that I may be pleased with them and give them good testimonials."

In other words, Hedin has unlimited space for anything personal, but almost no space for genuine science. Without detracting in the least from the readable quality of his book, he might have made it a permanent contribution to science, instead of an ephemeral story-book. On the physical side of geography he suggests various problems. For instance, he mentions the fact that the dissection of the Trans-Himalaya and Himalaya ranges is much greater on the south side than on the north, and attributes it to the heavy precipitation occasioned on the south by the monsoons. There is no suggestion of the alternative and more probable theory that the difference in the amount of dissection is due to the much steeper slope on the south. Again, frequent mention is made of wind-blown deposits of sand and loess along the sides of the great flood-plains of the plateau. Yet we find no hint of the fact that observations of this sort are of great interest to science; for geologists have surmised that the loess of the Danube and Mississippi valleys and of other portions of Europe and America may indicate that during the glacial period conditions of climate and river-flow in those regions were almost identical with those prevailing to-day in Tibet. Still another physical problem which Hedin neglects, is that of the numerous old lake strands which he notes again and again. In a few pages he might have summed up his observations, and given us some idea of how many such strands there are, their average elevation, the climatic conditions which they indicate, their relation to the glacial period and to similar strands in other parts of the world, and finally their relation to possible changes of climate in historic times. In regard to this latter point Hedin, in volume II, pp. 147, 154, et al., gives some account of the historic fluctuations of Lake Manasarowar, but fails to connect his statements with any great principle or problem which shall serve to give them significance to the reader.

Turning now to the field of human geography, the reader is beset by the same feeling of dissatisfaction as in the physical realm. On the northern border of the habitable portion of Tibet, or rather just beyond it, where the country is too high for agriculture or even for sheep-raising, he informs us that a considerable number of hunters wander about in summer. Wild yaks, wild asses, antelopes, sheep and other animals furnish them with a living. In the same region other nomads follow the mining profession, and eke out a poor existence by panning gold. In slightly lower regions, where grass begins to grow, the inhabitants are still nomads,—pastoral people who drive their sheep and yaks from place to place, and live in greasy little huts. Among them, bands of robbers are a frequent scourge. Still lower in the valleys of the great rivers, the Tibetans are able to rely upon agriculture for a living, and therefore live in permanent villages. A chapter devoted to each of these types of population would have made most interesting reading; and no one has the knowledge needed for such chapters more fully than Hedin. The dirtiness of the Tibetans, their architecture, methods of business, universal good temper, combined mildness and firmness, peculiar

monastic and matrimonial systems, and special form of government are all highly interesting matters to which reference is often made in the book; but the reader gets only the most fragmentary conception of them. They can be understood only through a comprehension of the effect of the physical character of Tibet upon the life of the people; and only the vaguest hint of any such relationship is to be found in the work.

In reading the account of Hedin's splendid courage and persistence, one's thoughts naturally turn to other explorers who have been noted for the same qualities. During the past century no one, perhaps, except Livingstone, has surpassed Hedin in these respects. Both must be highly honored for what they have accomplished in the face of tremendous difficulty. Yet there is a wide difference in the value and permanence of the results obtained. The difference is due apparently to the motive with which the explorations of each were undertaken. Three great motives have prompted travellers: First, the altruistic motive which kept Livingstone at his task till the bitter end, and caused him deliberately to set aside honor and his own ease for the sake of the oppressed natives of Africa. Second, the love of science. It was this which animated Darwin, and caused him to write the famous "Voyage of the Beagle." Finally we have the personal motive, pure love of adventure and the desire to be the first to explore new lands. Hedin's volumes are preeminently typical of this last motive. It is not the purpose of this review to compare the work of Hedin with that of other travellers, but any attempt to estimate the value and permanence of his work inevitably leads to a consideration of the effect which an explorer's purpose exerts upon his results. ELLSWORTH HUNTINGTON.

Landeskunde von Chile. Aus dem Nachlass von Dr. Med. Carl Martin, Puerto Montt (Chile). Für den Druck durch gesehen von Prof. Dr. P. Stange in Erfurt. Mit einem Lebensumriss und einem Portrait des Verfassers, 73 Abbildungen auf 36 Tafeler und einer Karte von Chile. Publikation des Geographischen Institutes der Universität Jena. Verlag von L. Friedrichsen & Co., Hamburg, 1909.

The author of this valuable book was one of those Germans, more numerous a generation ago than nowadays, who left their country in search of the unknown and on that search took root in a foreign soil, and there helped to develop their adopted country and to supply the rest of the world with contributions to its knowledge of their new homes. A physician by profession, Dr. Martin had nevertheless the true geographical instinct which, aided by his travels, enabled him to leave us, as the result of forty years spent in the trans-Andean republic, this monograph upon which a professional geographer could hardly have improved. Like most of us, Dr. Martin sees the greatest geographical problem of the country in its extraordinary extension through 40 degrees of latitude with a width in places no larger than the distance New York—Boston. Yet the unity of the nation does not seem jeopardized by it. With the exception of the northernmost provinces which have been under Chilean government for a short time only, and whose physiographic conditions, too, differ notably from the country south of the desert region, the population is entirely one, in spite of the admixture of foreign blood. There is an interesting resemblance between the 13 colonies before the American War of Independence, and Chile, in their being shut in between the ocean on one side and a mountain barrier on the other, and the

unifying effects of the location seem to be the same. On the other hand, Argentina resembles French Canada in its physiographic aspects and political expansion over the Hinterland, which results in a much lesser hold on the soil.

The great longitudinal valley is the heart of the country; its inhabitants are almost exclusively Chilean, the majority of the foreigners live in the seaports, but their number is insignificant in proportion to the whole population. The natives, although more numerous even than the foreigners, are of no account. Thus the bulk of the population is entirely Spanish. It descends from colonists from northern Spain, mixed with later immigrants from Northern and Western Europe, which gives it, in respect of the sturdiness and energy of the race, an enormous advantage over Argentina, whose founders came from southern Spain, and whose immigrants hail mostly from Italy and the south and east of Europe.

Socially the English-speaking foreigners are most conspicuous, while the Germans, similar to those of the Middle West in the United States, are mostly peasants who have cleared the forests and settled on their own farms. They form colonists of pioneers in the wilderness, especially in Llanquihue, and, a rare case in the New World, they have preserved their language in spite of their loyalty to the new country, while the English either intermarry with the Spaniards or return to the old country after having acquired a fortune. Other nationalities are not worth mentioning; those of southern Europe generally associate with the natives; those of northern Europe—including, curiously enough, the Czechs—associate with the Germans. In all, the combined number of foreigners is about 1 per cent. of the total population.

The country has free public schools and all kinds of higher institutions of learning. The separation of Church and State is a fundamental principle of the Constitution; yet the Roman Catholic Church is, to a certain degree, protected by the State. It is a continuous source of trouble in the extreme North where the priests are still appointed by the Peruvian bishop as in the old times, and thus keep Peruvian sympathies alive in the conquered provinces.

Valparaiso is the leading commercial city, not on account of its harbor, which is open to the dangerous north and northwest winds, but on account of its nearness to Santiago which, controlling the paths across the mountains, was an important center even in Inca times. The harbor of Aninteros near by is much safer, but as the capital for its development is at Valparaiso, the commercial and financial center, there is little probability that such a scheme will ever be seriously considered. The intellectual center, on the other hand, is Santiago, and Concepción is the railway center. Chile needs railroads to connect its widely distant provinces, and thus a large percentage of its lines, while they do not pay and probably never will, are run by the government as a means of unification for the country and nation. The backbone of the system is the line along the central valley from Valparaiso to Puerto Montt, where it connects with a steamboat line to Cape Horn. Numerous smaller steamboat companies keep up a lively traffic along the coast. But not before the completion of the trans-Andean Railroad and the Panama Canal will the national resources of the country be fully developed. The larger part of the 777 pages is given to a vivid description of these wonderful resources. Numerous illustrations, half tones and colored plates aid the text in describing the character of the landscape. A very fine map, two indexes, and an extensive bibliography bear testimony to the thoroughness with which the volume was prepared. It is a pity that the author did not live to see it finished. MARTHA K. GENTHE.

The Palisades of the Hudson. Their Formation, Tradition, Romance, Historical Associations, Natural Wonders and Preservation. By Arthur C. Mack. 58 pp., Map and Illustrations. The Palisade Press, Edgewater, New Jersey. 75c.

An excellent little book which all who love the Palisades should read. The description of the formation is clearly expressed and will give an accurate idea to the general reader. The best feature of the book is its description of the rich historical associations of the Palisades. These details will open new sources of enjoyment to those who love to wander along this wonderful sentinal wall overlooking the Hudson.

Cyrus Hall McCormick. His Life and Work. By Herbert N. Casson. xii and 264 pp., Illustrations, and Index. A. C. McClurg & Co., Chicago, 1909.

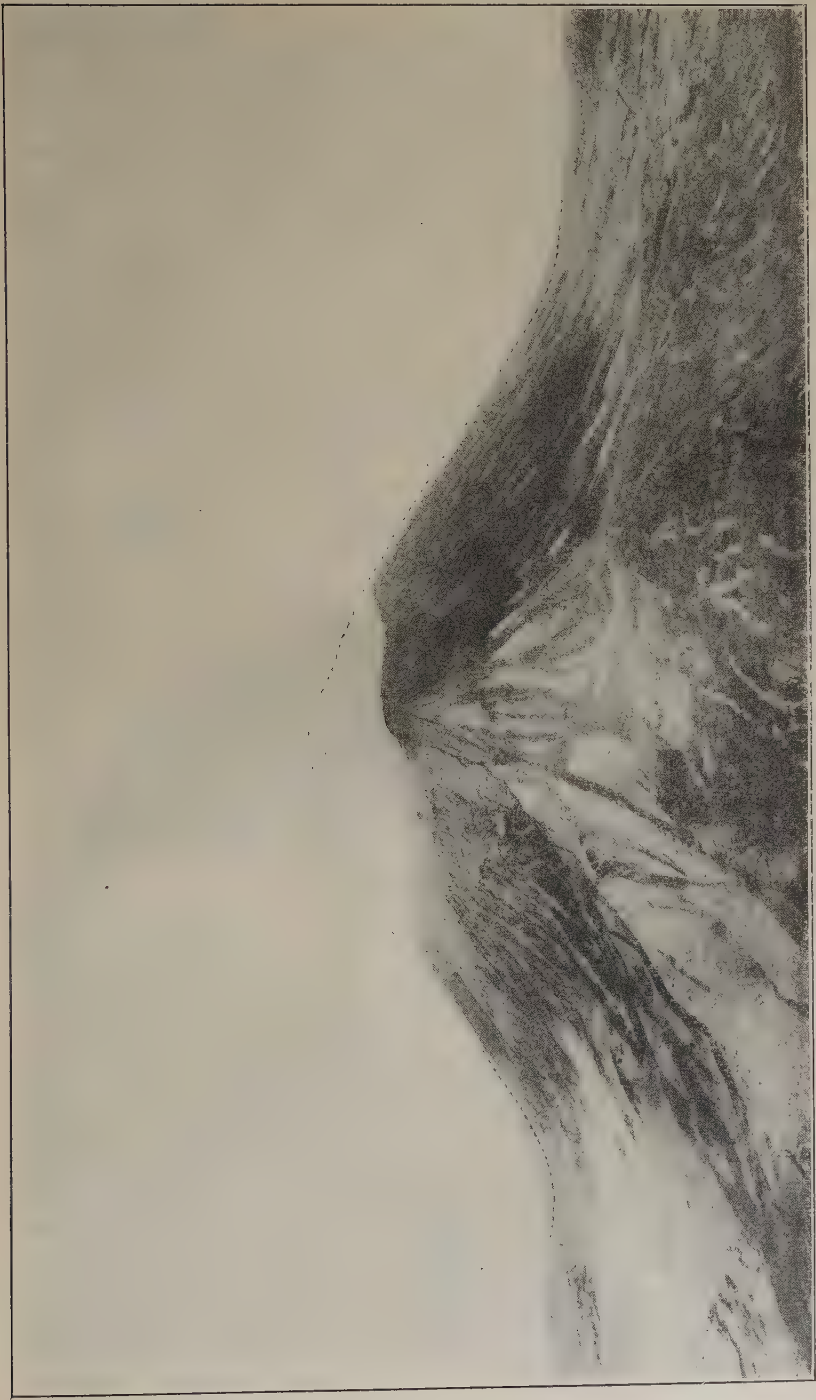
American farmers were saying, when Cyrus H. McCormick was a farmer boy, that though wonders of invention were coming to pass, they did not think it possible that a machine would ever be made which would cut grass and grain. McCormick made his name a household word in many lands by evolving a practical machine which, as its inventor perfected it, completely filled the need of the vast multitude of grain growers. To this day, the making of reapers has remained an American business. This book tells, with sympathy and authority, the whole story of the life and work of the great inventor and of the evolution of the machine that made it possible for the United States to become the greatest wheat-growing nation.

The Eruption of Vesuvius in April, 1906. By H. J. Johnston-Lavis, M.D. 62 pp., 16 Photo-engraved Plates, 2 plans, 2 figures, and 2 colored maps. Reprinted from the *Sci. Trans.* of the Royal Dublin Society, Vol. 9, Part 8, Jan., 1909. Univ. Press, Dublin, 1909.

Over twenty years ago Dr. Johnston-Lavis published his Geological Map of Vesuvius. In the present work (a quarto) he calls attention to the severe paroxysms that shook the flanks of the mountain in the Nineteenth Century and especially those of 1872 and later, the outburst of 1872, which was the most important preceding that of April, 1906. These later eruptions added no less than five great, solid masses of lava to the volcano.

All but five introductory pages are given to a description and discussion of the phenomena of the remarkable eruptive period of 1906. The work forms the most complete scientific treatment of all phases of the great eruption of 1906 that has appeared in English. The dominant features of the eruption were the extensive truncation of the great cone and the large amount of fragmentary ejecta spread over the mountain and region around Vesuvius.

Dr. Johnston-Lavis says that if we go back over a century we may give many examples of as extensive outflows of lava, but the only parallel for paroxysmal energy and degradation of the cone is that of 1822. The *Bulletin* reproduces here one of the many photo-engravings in the book. It shows the aspect of the great cone of Vesuvius on May 4, 1906, as seen from the Punta del Nasone on Monte Somma looking due South. The view gives a good idea of the remarkable truncation of the cone. The dotted line shows the outline of Vesuvius in Oct., 1903, taken with the same camera and lens, and represents, except for a faint variation at the extreme summit, the actual outline of the cone before it was truncated by the last eruption.



TRUNCATION OF MT. VESUVIUS.

See p. 220.

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Map of Birmingham District, Ala., showing outlines and relations of iron ore, coal, limestone and other economic Features. 1 inch=7 miles; (c) Geologic Map of Woodstock Brown Ore Area, Ala. 1 inch=13.7 mile. With *Bull.* 400, "Iron Ores, Fuels and Fluxes of the Birmingham District, Ala.," by E. F. Burchard and C. Butts, Washington, 1910.

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United States. Soil Survey Maps of Bibb and Cullman Cos., Ala.; the Pajaro Valley, Cal.; Allen Co., Ind.; Livingston Co., N. Y.; The Klamath Reclamation Project, Ore. 1 inch=1 mile and 1 inch=0.9 mile. [In colors, with contours of elevation. Each map accompanied by descriptive text.]

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MEXICO. (a) Plano Puerto de Coatzacoalcos. 1:10,000; (b) Salina Cruz. Obras del Puerto. 1:6,000. With "El Ferrocarril nacional de Tehuantepec y los Puertos de Coatzacoalcos y Salina Cruz," by Civil Engineer Gabriel M. Oropesa. In *Memorias y Revista* de la Sociedad Cientifica "Antonio Alzate." Tomo 25. Nos. 9 á 12, Federal Government, Mexico City, 1909. [Black plans of these terminal ports of the Tehuantepec R.R.]

SOUTH AMERICA

BRITISH GUIANA. Map of British Guiana. 1 inch=50 miles. 1°-8° 50′ N.; 56° 10′-61° 30′ W. Compiled from the most recent Surveys in the Department of Lands and Mines. With "Handbook of British Guiana, 1909," Permanent Exhibitions Comm., Georgetown, 1908. [A colored map showing ocean and land steam routes, roads, postoffices and government stations, Indian reservations, and rubber, gold and diamond areas.]

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LAKE TITICACA. (a) Cortes del Lago Titicaca. [Six profiles of the lake, the vertical scale for depths being a 50-fold exaggeration of the horizontal scale.] (b) Mapa Batimetrico del Lago Titicaca. 1:825,000. Mission G. de Créqui Montfort y E. Sénéchal de La Grange. Edited by Dr. Neveu-Lemaire. [4 colored symbols for depths. The maps illustrate "Los Lagos de los Altiplanos de la América del Sud" by Dr. M. N. Lemaire. Spanish translation by Dr. B. D. Romero. Dirección General de Estadística y Estudios Geográficos, La Paz, 1909.]

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GERMAN SOUTHWEST AFRICA. Stadtplan von Windhuk. No scale. *Deutsche Kolonialz.* Vol. 27, No. 7, Berlin, 1910.

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TRANSVAAL COLONY. Map of the Transvaal Colony. 1 inch=30 miles. Compiled in the Surveyor General's Office, Pretoria, 1902; revised Jan., 1909. With *Report* of the Geol. Surv. for 1908. Pretoria, 1909. [Shows, in colors areas surveyed up to the end of 1907 and those completed during 1908.]

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CENTRAL ASIA. Dr. Aurel Stein's Routes in 1906-08. (In Hungarian.) 1:4,000,000=63.16 miles to an inch. 34°-44° N.; 74°-101° E. *Bull.* Hungarian Geog. Soc., Vol. 37, No. 8, Budapest, 1909. [In colors, with routes in red.]

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THE PHILIPPINES. Reconnaissance Map of the Geologic Districts of Leyte. 1 inch=22 miles. With paper "Geological Reconnaissance of the Island of Leyte, etc.," by George I. Adams. *Phil. Jour. of Sci.,* Vol. 4, No. 5, Manila, 1909. [Colors show different formations.]

TIBET. Geological Map of parts of the Province of Tsang and Ü in Tibet. 1 inch=8 miles. With "The Geology of the Provinces of Tsang and Ü in Central Tibet," by H. H. Hayden, Supt. Geol. Surv. of India. *Memoirs* Geol. Surv. of India, Vol. 26, part 2, Calcutta, 1907. [8 tints for geological formations. The map shows the results of the traverse made through a considerable part of Central Tibet on the Younghusband expedition to Lhasa.]

AUSTRALASIA AND OCEANIA

WESTERN AUSTRALIA. Geological Sketch Map of the Country along Route of proposed Transcontinental Railway. 1 inch=20 miles. 30°-33° S.; 121°-129° 15′ E. By C. G. Gibson. With *Bull.* 37, same title, of the Geol. Surv. of Western Australia, Perth, 1909.

NEW ZEALAND. The following maps, in colors, appear in "The Geology of the Mikonui Subdivision, North Westland," *Bull.* No. 6, New Series, New Zealand Geological Survey, Wellington, 1908: Topographical and Geological maps, 1 inch=1 mile, of the (a) Waitaha, (b) Toaroha, (c) Mount Bonar and Parts of Wanganui and Poerua, (d) Totara, and (e) Whitcombe Pass and Portions of Poerua and Butler Survey Districts. James Mackintosh Bell, Director, Geological Survey. [Excellent maps, giving a large variety of information.]

DUTCH NEW GUIANA. (a) Overzicht der ontdekkingen in Ned. Nieuw-Guinea tot begin 1908. 1:3,000,000; (b) Kaarten van Zuidwestkust van Nieuw-Guinea. Various scales. [Six sketch maps showing results of coast surveys and soundings]; (c) Etna Baai. 1:75,000. 3° 54′-4° 5′ S.; 134° 5′-134° 57′ E. [Geological coloring, with soundings and nature of coasts]; (d) Rivierverkenningen in Z. W. Nieuw-Guinea. Oetakwa of Tania R (5° S.; 137°-13′ E.) and an unnamed river (5°-16° S.-137° 40′ E.) Scale of river lengths, 1:100,000; breadths, 1:40,000. By Capt. E. J. de Rochemont, Sept.-Oct., 1904. [Showing depths and kinds of vegetation along river banks. These rivers have not been indicated, hitherto.] (e) Digóel Rivier, 1:200,000. By R. Posthumus Meyjes,

March and April, 1905. [A detailed black map of the entire course of the river, with soundings and nature of vegetation along the banks.] (f) Zuidwestkust Nieuw-Guinea, 1:1,000,000. 3°-8° 30′ S.; 134° 30′-141° E. [Colored map collating all the survey work of the Southwest New Guinea Expedition, 1904-5 of the Royal Dutch Geographical Society. These maps illustrate "De Zuidwest Nieuw-Guinea Expeditie, 1904-5, van het Kon. Ned. Aardrijkskundig Genootschap," E. J. Brill, Leyden, 1908.]

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AUSTRIA-HUNGARY. Das Tatragebirge. Einteilung und Verteilung der mittleren Höhe. 1:300,000=4.73 miles to an inch. With paper "Einteilung und Orometrie des Tatragebirges nebst einem Beitrag zur Wald-und Knieholzgrenze.' By A. Holle. In *Abhandlungen* k. k. Geog. Gesells. in Wien, Vol. 8, No. 2, Vienna, 1909. [Curves of elevation, with 200 meters interval and superimposed transparent sheet with contours showing heights at which timber and scrub grow.]

AUSTRIA-HUNGARY. (a) Schi-Routenkarte der Niederösterr.-Steirischen Kalkalpen. 1:100,000=1.5 mile to an inch. (b) Schi-Routenkarte des Ob. Ennstales u. d. Rottenmanner Tauern. 1:100,000. G. Freytag & Berndt, Vienna, 1909. Paper, K. 2, Linen, K 2.80. [Two of the superior tourist maps of this firm showing in red the ski routes and those adapted only for climbing, refuge huts, mountain hotels, forests and much other information.]

AUSTRIA-HUNGARY. G. Freytags Verkehrs-Karte von Österreich-Ungern. 1910. 1:500,000=23.67 miles to an inch. G. Freytag & Berndt, Vienna, 1910. Paper, K 2.40. [This annually revised map gives the fullest information on transportation in the Empire. An inset shows the connection of the imperial railroad system with that of the Balkan States and Turkey. An index to all railroad stations (52 pp.) refers to index-letters and numerals on the map margin.]

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Ecuador. Nouvelle méridienne de Quito. 1:3,000,000.

Spitzbergen. Arc du Spitzberg. 1 inch=59 miles.

North America. Principaux arcs de l'Amérique du Nord. 1 inch=1,100 miles.

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BULLETIN

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SIR ERNEST SHACKLETON RECEIVES THE CULLUM GEOGRAPHICAL MEDAL

A special meeting of the Society was held at the Engineering Societies' building, on Monday evening, March 28, to welcome Sir Ernest Shackleton and present to him the Cullum Geographical Medal in honor of the great results of his Antarctic expedition of 1907-09. A large number of Fellows and their friends were present. On the platform, with the guest of honor, were President Huntington, members of the Council, Mr. Henryk Arctowski, the meteorologist of the Belgian Antarctic expedition, and Mr. Edwin Swift Balch, one of our leading writers on polar exploration.

The President made the following remarks in presenting the medal to the explorer:

"There is pleasure in acknowledging superiority of achievement by those qualities which are closely allied to all really great action.

"The man to whose character our Society renders its tribute of admiration and respect, who brings to us truth from the secret places of the earth, who, like one other of this great Anglo-Saxon race, has drawn back the veil of ice and cold from polar mystery; this man we welcome to-night, and to him I have the honor to tender the medal of the Society—the highest distinction within our power to give.

"Ladies and gentlemen, I introduce to you Sir Ernest Shackleton, whose home is in England—and in the hearts of all Americans."

Sir Ernest Shackleton, who was most heartily greeted by the audience, replied:

"Mr. President, I thank you for the kind words you have spoken in conferring this great honor upon me. I do indeed feel that I am

at home in America, for I have been made to feel so by the kindness of all whom I have met since my arrival here. This is a great pleasure to me and it will be a pleasure to my countrymen and my comrades who in the Antarctic made it possible for our expedition to win the results for which the American Geographical Society has to-night conferred upon me this distinction. I little dreamed when your Society paid a similar tribute to Capt. Scott, my former leader in the Antarctic, that I also should, some day, receive a medal from your hands. I appreciate the honor with all my heart."

The inscription on the medal is:

"Awarded to Ernest H. Shackleton in honor of his great Achievement in Antarctic Exploration. M C M I X."

The explorer then gave an hour to an exceedingly interesting account of the work of his expedition, illustrated by many stereopticon views. Mr. Balch, in the January *Bulletin,* made a comprehensive summary of the remarkable achievements of the party and, on our platform, Sir Ernest told the story in greater detail. His simple narrative was marked both by modesty and by humor and the audience followed it with the closest attention.

He told of the ascent of Mount Erebus from whose summit clouds of steam and smoke were almost incessantly trailing. The ascent was accomplished in spite of very low temperatures, the most difficult of ice climbing and a fierce blizzard that for over a day, swept down upon the men, keeping them to their tent. At the top, they looked down into the live crater.

Then he described his great southern journey on which he was accompanied by Adams, Marshall and Wild, with four ponies, four sledges and provisions for ninety-one days. It was on this journey, after sledging for eighteen days over the Barrier Ice, that the explorer penetrated more than 400 miles into the Antarctic continent, all the land he saw having been hitherto absolutely unknown. Among the many views of this land, he showed the place where they discovered thick beds of coal, the most remarkable geological find of the expedition.

The party were within 111 statute miles of the South Pole when the approaching exhaustion of the food supply compelled them to turn back. Sir Ernest said that, with fifty more pounds of food, he could have gone to the Pole and back. With the food they had, he could have reached the Pole, but the party would never have returned. As it was, on the return march, they ate their last scrap while still

thirty miles from the supply depôt and then struggled on for a day with nothing but tea to maintain their strength.

The lecture closed with a description of the journey, to the north-west, of the Magnetic Pole party that located the Pole and came back to the sea only to find themselves faced by open water. They were living on seal meat and blubber when the explorer's steamer *Nimrod* fortunately picked them up.

The lecturer was frequently applauded and the favor of the audience was especially indicated when he displayed on the screen the British flag as it floated over the spot that marked his nearest approach to the South Pole.

At the close of his discourse, a reception was given to Sir Ernest, the ladies and gentlemen going forward to the platform where Professor Libby of Princeton introduced them to the President, who, in turn, presented them to the explorer.

SOURCES OF AMERICAN RAILWAY FREIGHT TRAFFIC*

BY

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To understand the freight services of American railways one must have at least a general knowledge of the sources of traffic. The district and general freight agents and the traffic manager of any particular road must have detailed information concerning the territory served by their lines, and should also possess as broad a grasp as practicable of the resources and industries in all parts of the country. Unless the traffic official be thus equipped, he can hardly hope to serve his company efficiently. Likewise the transportation student, whether he be subordinate employee or executive official, who would so comprehend traffic problems as to be able to offer intelligent suggestions or to issue wise orders must know the transportation geography of his country.

This geographical knowledge necessary to a comprehension of American traffic problems and of the traffic policies followed by our

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* See also the Author's Paper "Characteristics of American Railway Traffic: A Study in Transportation Geography," *Bulletin*, Vol. XLI, 1909, pp. 610–621.

railroad companies, like most valuable assets, is not to be gained without careful study. The vast size of our country, the varied character of its resources, the multiplicity of its industries, and the volume and range of domestic trade and foreign commerce require the transportation expert to enrich his mind with a wealth of detail, and to acquire the power of applying his information constructively to aid in the solution of any problem or in the interpretation of any situation with which he may be confronted. He must, of course, know much more than can be presented in this outline of the geography of American railway freight traffic; details must be filled in either by studying books upon economic and commercial geography, or by travel and personal investigation; or, preferably, by both methods.

The railway freight traffic, whose geography we are studying, is grouped by the Interstate Commerce Commission into seven general classes of commodities: products of agriculture, of animals, mines, forests, manufactures, and merchandise, to which is added a residual category including "other commodities." This classification of products shows roughly the extent to which our rail tonnage is drawn from industries connected directly with our basic natural resources—the farms and ranches, mines, and forests—and to what extent from manufactures, of secondary industries. It brings out the fact that, for 1908, fifty-three per cent. of the tonnage is made up of minerals (coal, coke, stone, sand, etc.), not including petroleum which is classed as a manufactured article; that manufactures—not counting in flour, which is credited to agriculture, nor packing-house products which are placed with animal products—now comprise 15.4 per cent. of the traffic; that lumber and other forest products, other than naval stores which are considered to be manufactures, amount to 11⅓ per cent. of the total; and that, despite our prominence in farming, agricultural products, grain and flour, cotton, hay, fruits, and tobacco, together with animal products, live stock, provisions, wool, hides and leather, aggregate less than eleven per cent. of the tonnage handled by the railroads.

Inasmuch as more than two-thirds of the tonnage consists of minerals and manufactures, the section of the United States where those commodities are most largely shipped will be the region making the heaviest contribution to rail traffic; and the portions of the country where grazing, farming, or even forest industries lead, will rank much lower in total tonnage. Indeed, in that relatively small part of the United States north of the Potomac and Ohio rivers and

east of Illinois and Lake Michigan—including only one-ninth of the land area of our country—where mining and maufacturing are most extensively carried on—more than one-half of the total tonnage of our railroads originates; whereas, the southeastern section lying east of the Mississippi and south of the Ohio and Potomac, although a prosperous region having once and a half the area of the northeastern district, and including the West Virginia and Alabama mines, its extensive pine and hardwood forests, and its broad cotton fields, ships only one-eighth of the total tonnage moved by our railroads. The remainder of the United States with 72½ per cent. (nearly three-fourths) of the entire land area, and, with the heavy ore shipments of northern Michigan, Wisconsin, and Minnesota and the bulky lumber traffic of the far Northwest to swell its total, creates less than one-third of the aggregate railroad tonnage. The major share of the freight traffic of our railways originates in a few sections of relatively small area, while over the larger part of the country the tonnage per mile of road and square mile of territory is comparatively small.

A closer view of the sources of our railway freight traffic can be gotten by studying in turn the southern, eastern, central, Cordilleran, and Pacific coast sections of the United States. It will be necessary to limit the study to a review of the principal resources and industries, to some consideration of the markets reached in domestic and foreign trade, and to a general analysis of the traffic of one or more typical railroads in each of the designated regions. It will be well to begin with the Southern States, or the southeastern and Gulf district instead of the northeastern section, because the economic activities of the South are less complex.

The raising of cotton has been the dominant industry of the South for a hundred years; and, although the utilization of mineral and forest resources is broadening the economic life, the growing of cotton and the use of the staple in manufactures now hold and will probably retain first rank. The rapid increase in the number and capacity of cotton mills in the South has latterly added strength to the industrial position of the cotton crop. The cotton belt, extends with widening area from Virginia to Texas and Oklahoma, and occupies the Piedmont of the Carolinas, Georgia and Alabama, the lower Mississippi Valley, with the exception of the lowlands along the Gulf, eastern Texas, most of Arkansas, and parts of Oklahoma, Tennessee and Missouri. This is the heart of the South, the home of most of its population, and, until the recent development of com-

merce and of iron and steel manufactures, it was the theatre of most of its economic life.

The tonnage supplied directly by the cotton crop, however, is not large; for the annual and immensely valuable yield of about 14,000,000 bales weighs only 7,000,000 tons, or about one per cent. of the total railway tonnage of the country; but a crop having a market value of $800,000,000 makes possible and necessary an active traffic in other goods into and out of the region where the crop is grown. Cotton culture directly and indirectly accounts for a large share of the traffic of the southern railways.

Of the 14,000,000 bales of American cotton somewhat more than one-third (5,000,000 bales), and a rapidly rising share, is worked up in our own mills; and the remainder is exported. Thirty years ago the chief center of the cotton production was in the Piedmont and in the other States east of the Mississippi; and in those days the largest interior market was Atlanta. Charleston and Savannah, as well as New Orleans and Mobile, were then important exporting gateways; but with the extension of the cotton belt into the States west of the Mississippi river, particularly into Texas, Houston has become the leading primary market, with Memphis, Fort Worth and Dallas also ranking high. Galveston has gained such a lead over other exporting points that, in 1907, her shipments abroad amounted to about three and a half million bales. New Orleans had second place with two million bales, and Savannah third position with less than one million. There was a short but probably temporary decrease in the cotton exports from Galveston and New Orleans, in 1908, due to the boll weevil.

The decline in rank of the South Atlantic seaports in the cotton export trade has, however, been due not only to the westward movement of the area of production, but also to the rapid rise of cotton manufacturing in the Piedmont section of North and South Carolina, Georgia, and Alabama—the four States in which most of the cotton mills of the South are located. The North Carolina mills require more cotton than is grown in the State; and those in South Carolina provide a market for nearly three-fourths of the home-grown staple. At the present time nearly two-fifths of the cotton spindles in the United States are running in the cotton-growing States, and most of the other sixty-two per cent. are in New England, Massachusetts still having nearly as many spindles as there are in the South; but the ratio is changing, the increase being more rapid in the Southern States.

This survey of the production and distribution of cotton shows that three changes are taking place in the cotton traffic of the southern railroads:—that the tonnage is rising with the rapid increase in the annual crop; that the railways in the western cotton states—those lines converging upon Houston, other Texas markets, and Memphis, and connecting these interior markets with Galveston and New Orleans, instead of the railways in the states east of the Mississippi river—have become the chief carriers of cotton; and that, while the shipments to the seaboard for export grow greater year by year, a larger percentage of the crop is being brought by rail to the mill towns in the Piedmont and by rail and coastwise steamers to the textile centers of New England. The manufacturing progress of the South is causing an increasing share of the raw cotton to be shipped to points within the South; while the shipments out of the Southern States to other parts of the United States and to foreign countries, mainly the Orient, are including a steadily enlarging volume of cotton goods.

Despite the fact that the South is chiefly engaged in agriculture, over half the railway tonnage consists of mineral products, chiefly coal, iron ore, petroleum, phosphate rock, and building materials, coal holding first place. The most productive coal field south of the Potomac and Ohio is the one lying mainly in West Virginia and extending into Virginia, Kentucky, and Maryland. From this district is taken about seven-ninths of the coal mined in the South, some of it being shipped by water down the Kanawha river, but most of it by rail, in part to western markets and more largely to the Atlantic seaboard for further distribution. The output of the rich Alabama field, now one-sixth of the southern coal, is chiefly used locally in the Birmingham iron industries, but is also shipped to other interior markets in the South, as well as to the Gulf ports. It is expected that the Panama Canal will increase the shipment of Alabama coal to and beyond the Gulf seaboard. Kentucky and Tennessee find ready markets for their tonnage within or not far beyond their borders. Texas has some coal, and more is obtained in Missouri, Arkansas and Oklahoma. Taken as a whole, the coal traffic of the southern railways has numerous sources and moves thence in all directions. It is increasing rapidly with the industrial progress of the South.

The all-important iron ore district of the South is close to Birmingham, Ala., where about two-thirds of the southern ore is mined; the other third coming mainly from Tennessee, Virginia and Georgia. The Alabama ore is smelted close to the mine mouth,

and that of the three other states requires but short hauls to reach the furnaces. The iron ore traffic of the southern railways is relatively unimportant in comparison with the tonnage of this commodity handled by the roads in Pennsylvania and about the Great Lakes where most of the crude iron, amounting to more than four-fifths of the total output of the country, and to seven times that of the South, is moved long distances, most largely by joint rail and water routes, but also to some extent by all-rail transportation.

During recent years the southern, and what are usually named the southwestern states have become the source of nearly forty per cent. of the petroleum secured from American wells. Formerly the oil was obtained almost entirely from the northern Appalachian district; later the so-called mid-continent field lying mainly in Oklahoma, and extending somewhat into Kansas and northern Texas, had the largest output; now California comes first, and the Appalachian section third. Three-fifths of the petroleum output of the southern and southwestern states in 1908 came from Oklahoma, and the remainder mainly from Texas, Louisiana, and West Virginia.

As is well known, most of the crude petroleum is transported by pipe lines or by pipe line and tank steamer to the refineries where illuminating oil is prepared, or to the storage tanks of fuel oil; but tank cars as well as pipe lines are used especially in the Louisiana, Texas and California fields. The oil tonnage of the railways is made up chiefly of the refined products which are handled chiefly in bulk in tank cars, although much is shipped in barrels. Many of the numerous by-products are necessarily put into cases or packages for shipment, The services performed by the railroads in transporting oil consist principally of connecting the refineries with the many thousand places where petroleum products are retailed.

The phosphate rock now mined in the United States, amounting to 2,386,000 tons in 1908, is secured from beds in Florida, Tennessee, and South Carolina. The Florida rock, which is two-thirds of the total, is taken from the western part of the central portion of the peninsula, and is shipped as crude rock from Port Tampa mainly to foreign countries. The greater part of the Tennessee output is sent to various parts of the United States for domestic consumption, about one-sixth being exported by way of Pensacola, Norfolk, and Newport News. The South Carolina beds are near Charleston, and the crude rock there obtained is worked up into fertilizers which are distributed widely within and beyond the United States.

The other large source of the traffic of the southern railways—

and it is outranked in tonnage only by coal—is the forests. The forests of the Southern States, which now far surpass the other lumber-producing sections, the northeastern, the Lake States, and the Pacific slope, in the value and quantity of the annual cut, include two separated areas—the yellow pine belt paralleling the Atlantic and Gulf, from North Carolina to Texas and reaching north into Arkansas, and the hardwood belt covering the Appalachian mountains and extending across the states lying to the west-northwest of the mountains. From these forest sources, a fifth of all the tonnage of the southern railways is secured. The pine belt has the larger output, the leading states being Louisiana and Mississippi, but all the Gulf States make large contributions to the total; while Georgia, North Carolina and Virginia are also drawn upon heavily. Practically all of the larger Gulf and south Atlantic seaports have heavy lumber shipments, a part of the product, particularly that of the Gulf ports, being exported while the major share is shipped coastwise for domestic use. An important feature of the rail traffic of the South is the transportation of large tonnages of lumber from the interior to the seaboard.

The great center of the hardwood lumber industry is Memphis. Tennessee stands eighth among the Southern States in value of lumber products; but Arkansas ranks third and Mississippi second. The railroads converging upon Memphis from Tennessee, Arkansas, and northern Mississippi transport large quantities of timber and rough lumber and make that a great milling district, from which the finished product is shipped over a wide territory. Kentucky and West Virginia each produce more lumber than Tennessee does, the output of these States now being marketed, in large part, north of the Potomac and Ohio.

The traffic of the railways in the *northeastern section* of the United States includes such a great variety of commodities and is drawn from so many sources that a discussion of its origin must avoid detail. It will be convenient to consider the northeastern section to include the states north of the Potomac and Ohio and east of Illinois and Lake Michigan; i. e., the first three of the ten territorial groups into which the Interstate Commerce Commission divides the United States in tabulating the mileage, financial and traffic statistics of the railways. By giving these limits to the northeastern section, Ohio, Indiana, and the southern peninsula of Michigan are associated with the East instead of the Central West; but this grouping is fully justified by the close connection of these

trans-Allegheny states with the industrial activities and commerce of the middle and New England States.

The large volume of railway freight in the northeastern district, while derived from many sources and composed of a great variety of commodities, consists mainly of four kinds of traffic: (1) Anthracite and bituminous coal, (2) iron ore and steel products, (3) manufactures of many kinds, especially textiles and machinery, and (4) the export and import trade. By considering the sources and routes of these four classes of traffic we shall account for the greater share—probably four-fifths—of the railway tonnage of this part of the United States.

The coal shipments far exceeed any other class of traffic in tonnage. Nearly half of the tonnage and more than half the value of all the coal mined in the United States is secured in Pennsylvania (200,000,000 tons in 1908); and above six-tenths of the total is from Pennsylvania, Ohio, Indiana and Michigan. Somewhat over one-third of the Pennsylvania coal consists of the anthracite secured from three small areas east of the Allegheny mountains. This coal, both anthracite and bituminous, is distributed generally over the northeastern section of the United States, and is handled mainly by the railroads, the principal exceptions being the shipments coastwise north from Norfolk, Newport News, and Philadelphia, the shipments out of this northeastern part of the United States to the north central section by way of the Great Lakes, and the barging of coal down the Ohio and Mississippi rivers. The great industrial centers, such as the Pittsburg district, and Cleveland, and the metropolitan Atlantic seaboard cities, are the chief centers towards which the coal moves from the northern Appalachian field.

The mineral traffic, comprising nearly six-tenths of the total railway tonnage of the northeastern section, consists mainly of coal, coke, and iron ore. The iron ore is derived in part from the mines of New York, Pennsylvania, and New Jersey and a small amount is imported; but the chief sources of supply for the furnaces and mills of the northeastern states, in which most of the iron manufacturing of the United States is done, are the mines of northern Minnesota and upper Michigan, which are brought close to Ohio, Pennsylvania, and New York by cheap transportation on the Great Lakes. The ore traffic from the Lakes to the furnaces, and shipments of iron and steel and the manifold manufactures thereof from the mills to all parts of the country comprise a volume of freight second in tonnage only to that created by coal and coke.

It is the manufacturing activities of the northeastern states which directly and indirectly account for the heavy railway tonnage of that region. These industries are not only of great variety, but are generally distributed over the larger part of the district; and while railway traffic is largest in such industrial sections as central Indiana, eastern Ohio and western Pennsylvania, southeastern Pennsylvania, northern New Jersey, southeastern New York, and southern New England, the manufactures of other parts of the northeast give rise to no small rail tonnage. Without attempting to enumerate even the more important classes of manufactures, other than iron and steel, mention may be made of machinery and tools which are made in many parts of the section under consideration; of the ship-building plants on the Great Lakes and along the Atlantic seaboard; and of cotton, woolen and silk textiles whose mills are located chiefly in the region extending from Portland, Me., to Philadelphia. All of the cotton and silk, and nearly all the wool, used in the textile mills are brought from a distance; and the fabrics and carpets are marketed in every part of the United States, and to some extent abroad. The tonnage of rail traffic directly created by the textile industries is not large; but the concentration of population necessitated by these industries results in a great enlargement of the freight and passenger business of the railroads.

The major share of the foreign trade of the United States, both export and import, being handled through the north Atlantic ports, our foreign commerce contributes an important part of the traffic of the railroads connecting the Mississippi Valley with the seaboard from Portland to Norfolk. The export tonnage, which greatly exceeds that of the imports, formerly consisted mainly of the results of agriculture; but, while the products of our farms—cotton, cereals, fruits, animals, and animal products, etc.—still account for about six-tenths of the value of the commodities we sell abroad, our exports are steadily becoming more diversified with the progress of our manufactures, particularly those of iron and steel which now contribute one-tenth of the total value of our foreign sales.

The export shipments from the United States are more evenly distributed among our several seaports than are the imports; nevertheless one-third of the outbound commerce passed through New York; while Baltimore, Boston and Philadelphia, although outranked by Galveston and New Orleans, handle one-sixth of the exports. Much more than half of our outgoing foreign trade moves through the ports on the Atlantic coast north of Hampton Roads—the ports reached by the trunk line railroads.

The import traffic is more concentrated than are the export shipments. Six-tenths of all our imports enter via New York; and more than three-fourths of the total are brought in through the four largest North Atlantic ports. The commodities imported are of great variety, and consist largely of high class traffic; they are distributed generally over the country, and their transportation is eagerly competed for by the railroads of the northeastern section.

Railway traffic in the *Central West,* that section lying between Indiana and Lake Michigan on the east and the Rocky Mountains on the west, has a higher percentage of products of agriculture than does any other large subdivision of the country. This is the center of the cereal production in the United States, and is the district leading in the value of farm animals. Its principal railroads are popularly called the "granger lines."

These roads converge mainly upon four great centers (there are numerous more local foci), the greatest center being Chicago, or, more broadly considered, the southern and western shore of Lake Michigan. Minneapolis on the Mississippi, the great milling city, and Duluth and Superior, the transfer points at the head of Lake Superior draw to them a large traffic from the upper portion of the central west; while St. Louis, noted for its manufactures and jobbing trade, and Kansas City and Omaha, second only to Chicago in packing-house products, are the two great traffic loci in the southern part of the central west.

But large as is their traffic in grain, animals and animal products, the railways of the central west have a greater tonnage of minerals. Illinois with its 48,000,000 tons of annual output (1908) ranks second among the coal-producing states, while Iowa and Kansas with a combined production of 13,000,000 tons stand ninth and tenth in the list. Eight-tenths of the iron ore of the United States comes from the three states in the Lake Superior district, and while most of this ore is taken by a short rail haul to Lake Superior, it none the less swells the tonnage of the railroads. The mineral traffic of the railways of the central west, mainly coal, iron ore and copper has a tonnage more than double that of agricultural commodities, animals and animal products.

While in the central West, as a whole, manufactures are as yet relatively undeveloped, there are certain sections and numerous cities in which manufacturing is carried on so extensively as to cause the railroads serving them to transport a large tonnage of mill and factory products. Illinois, with its rich coal fields, with

the cheap lake transportation to it from ore mines of the Superior district, with its population of nearly 6,000,000, and its great metropolis of Chicago stands third in the list of manufacturing states. Missouri ranks seventh and Wisconsin ninth. Portions of these three states and some sections of the other commonwealths of the central west have become the home of a large variety of industries whose products are marketed generally over the United States and to a surprising extent in foreign countries.

At the southern end of Lake Michigan is an especially favored location for manufactures. Water-borne ore and near-by coal are brought together cheaply, while more than a score of railroads bring hither, over their converging lines, the natural products of the central west and take hence to all points of the compass the output of mill and factory. Like the Pittsburg district and the section along the south shore of Lake Erie, the Chicago district, within which may properly be included the new city of Gary, Ind., occupies a strategic position industrially, and its rapid progress is creating a vast railway traffic in non-agricultural commodities. A similar influence is being exerted by Milwaukee, Minneapolis, Duluth, St. Louis, and other cities. The traffic of the railways in the upper half of the Mississippi Valley is rapidly becoming diversified, as it flows into and out of an increasing number of industrial centers.

This productive middle portion of the United States located centrally within a broad continent, from 500 to 1,500 miles from the ocean has a surprisingly large volume of trade with our seaboard states and with foreign countries. Highly efficient railroad lines connect it with the Atlantic, the Gulf and the Pacific. Formerly, the Atlantic roads and the lakes carried out most of its exports which consisted chiefly of products of the farm; but now the Gulf route is taken by a large percentage of the cereals, and the Pacific lines also share in the outbound flour and provision tonnage. Meanwhile, the growth of population in the central west, the opening of its coal and iron mines, and the development of its manufactures, have lessened the importance of its exports of agricultural products, have enhanced the volume of manufactures—agricultural and mining machinery, engines, iron and steel, both crude and wrought into wares of many shapes and uses, vehicles of all kinds, etc.—and have enlarged the volume and variety of the commodities brought into the section from other parts of the United States and from abroad. In consequence, the trains that now take the products of the central west to the Atlantic and Pacific return with a profitable

"backload;" and though this can not yet be said of the roads to the Gulf, the northbound traffic is increasing, and will grow more rapidly with the opening of the Panama Canal and with the progress of our trade in Latin-American countries.

In the *Rocky Mountain section,* railway tonnage must always be less than in other parts of the country; although it is probable that most persons underestimate the traffic possibilities of the mountainous and arid West. At the time of the construction of the earlier Pacific roads, the great Cordilleran plateau was regarded mainly as a barrier to be surmounted to reach the traffic of the Pacific coast; but now the interior traffic sources are recognized to be of greater importance. Prosperous roads like the Denver and Rio Grande have depended mainly upon local rather than upon through traffic; and at the present time the northern transcontinental lines derive the larger share of their profits from the traffic of the places along their lines. This is probably not yet true of the southern lines to the Pacific, but even they are prospering increasingly because of the growth of local business.

The internal sources of traffic are the mines, ranches, irrigated districts, and the trade of such collecting and distributing centers as Denver, Salt Lake City, Cheyenne, Helena, Spokane, Albuquerque, El Paso, etc.

Coal naturally leads other minerals in the volume of tonnage; and one sure evidence of the industrial progress of the mountain States is the increase in the amount of coal mined, which has doubled in ten years. Colorado ranks eighth among the coal-producing States and Wyoming twelfth. Five per cent. of the coal mined in the United States, and one-tenth of that secured outside of Pennsylvania, comes from the Rocky Mountain States, not including those on the Pacific coast. More than two-thirds of our copper is mined and smelted in the Cordilleran States, mainly in Arizona, Montana and Utah, the only important copper state outside of this section being Michigan, from which one-fourth of the total output is secured. The mining of gold, silver and lead. likewise, gives rise to an important share of the rail traffic of the mountain district. The mining camps are distributed generally among the Cordilleran States, Colorado holding first place in the output of gold and silver and in the total production of minerals.

The ranches are the second source of the traffic of the railroads in the Cordilleran section. The eight States and territories comprising most of the Cordilleran plateau, Montana, Wyoming, Colo-

rado, New Mexico, Arizona, Utah, Nevada, and Idaho, contain nearly half of all the sheep in the United States; and if the three Pacific coast States, which are largely within the mountain district, be included, the sum is over three-fifths of the total for the country. Montana and Wyoming lead all the other States in number of sheep. The number of cattle in these mountain commonwealths, while not equal to those on the Texan ranches or the farms of Iowa and other Mississippi Valley States, is none-the-less large, amounting to about one-sixth of the total for the United States.

It is, however, the development of irrigation that promises most for the growth of the rail traffic of the mountain States. Such highly fertile sections as the Salt Lake Valley in Utah, the valleys of the Salt River and other streams of southern Arizona and New Mexico, the Imperial Valley of southern California, the Truckee-Carson district of western Nevada, the Uncompahgre Valley of western Colorado, and the irrigated portions of Wyoming, Montana, Idaho, and eastern Washington, these are to be the home of several millions of people and the sources of large railway traffic. The irrigation of those districts in the arid west to which water can be supplied is as yet only well begun; and while the irrigable sections comprise only a small percentage of the total area of the great West, the presence of these highly productive and thickly populated valleys scattered over the wide Cordilleran territory will require an increasing railway mileage and traffic.

Nothing more clearly indicates the increasing railway traffic of the mountain section than does the growth of such cities as Denver and Salt Lake City. Each place is the center of converging and radiating railway systems that unite it not only with the Pacific coast and the Mississippi valley, but also with most parts of the Cordilleran region. These cities and numerous other lesser, but growing, intramontane railway and population centers evidence most clearly the economic progress of the West.

The chief sources of railway traffic in the *Pacific Coast States* are the forests, the grain fields, the fruit farms, the ranches and the mines, and the inshore and deep-sea fisheries. The Alaskan trade and the growing business with the Orient and Mexico are other, though minor, sources. The products from these sources are in part shipped by sea to the Atlantic and across the Pacific; and in larger volume eastward by rail to markets in the Cordilleran, central and eastern sections of the United States. The Pacific seaboard States, which formerly had little commercial intercourse with

other parts of the country, now outrank all other sections in the width of the range of their commerce. The past development of these States has been rapid; but their future growth, aided by the large number of transcontinental railroads in service or nearing completion, by the enlarging markets in the mountain States, by the cheaper transportation by way of the Panama Canal to the American and European Atlantic seaboards, and by the steady tide of immigrants from Europe, will be even more phenomenal. It is easy to understand why so much capital is now being spent in adding new Pacific lines. The St. Paul was finished in 1909, the Western Pacific from Salt Lake to San Francisco, and the Kansas City, Mexico and Orient to the west coast of Mexico will soon be in operation.

The lumber from the magnificent forests of Washington, Oregon and northern California, is the largest single item of railway tonnage. The market for this lumber is no longer confined to places reached by water carriers, but includes the entire western part of the United States, and, for the most expensive grades, the Eastern States. The rates eastward from the great Northwest are especially low, because lumber is largely handled as a "backload" in cars that would otherwise run empty. Washington is now the leading lumber state, its output being one-twelfth of that for the entire country.

The production of wheat in California and Oregon has declined during recent years with the substitution of intensive for extensive farm cultivation; but in Washington the annual crop is still increasing, that state now ranking sixth in wheat production. All three states are growing increasing amounts of barley, the other important cereal crop of the section, California now having a long lead over all other states in barley production.

In southern California, and in portions of central California, and Oregon, the orchards and vineyards originate the major share of the rail tonnage. The California green fruits are now sold in a well-organized market that includes the entire United States; her canned and dried fruits, wines, raisins, olives, olive oil, and almonds have an even wider sale. Horticulture and viticulture, are the chief sources of wealth in California, and in parts of Oregon. The present large shipments of green and prepared fruits will undoubtedly increase more than proportionally with the growth in the population of the United States. Furthermore, the development of the Pacific coast states in fruit production means that they will have sections containing relatively closely settled communities of prosper-

ous people and the rail traffic, inbound, as well as outbound, will consist largely of high-class, profitable freight.

While California has long since ceased to be preeminently a mining and grazing state, it is second only to Colorado and Alaska in the output of gold, unless, perchance, the mines at Goldfield may have now given Nevada the third place. California is now the ranking State in the output of petroleum, and the market value of the 45,000,000 barrels of this mineral annually obtained from the California wells is nearly equal to the value of the gold yearly mined. For industry and commerce, the petroleum is far more important than the gold. It is used instead of coal in the locomotives, and to a large extent in stationary engines; and it constitutes one of the larger items of railway traffic in the state.

Washington is the only one of the Pacific coast states that has coal enough to be of commercial importance, and its mines have an annual output of less than 4,000,000 tons. The mines of Vancouver, which yield two and a half times this quantity and a product of better quality, are the chief source of the coal used on the Pacific coast. The Vancouver coal, however, is mainly distributed by water and contributes but little to the tonnage of American railways.

The grazing industry in the Pacific coast states, particularly in Oregon and California, is important, although the ranches are giving place to farms. For some time to come, California and Oregon will have surplus wool, sheep and cattle for shipment to other states.

The fisheries of the Pacific coast states and Alaska yield an annual product worth $17,200,000, and constitute an important industry. The salmon catch accounts for over two-thirds of the total value, and formerly this had its chief centers in the Columbia River and the tributaries of Puget Sound, but now the waters of British Columbia and Alaska are more productive, the value of the Alaskan salmons being more than double that derived from the waters of Washington and Oregon. The trade in this fish, both fresh and canned, including the Alaskan product, is handled through the ports of our west coast states, from whence it is distributed generally over the United States.

The rapid growth of the export and import commerce handled at the Pacific ports of the United States has contributed largely to the tonnage and earnings of the transcontinental lines, for the reason that a large share of the exports are brought from the farms of the upper Mississippi Valley, the cotton mills and plantations of the South, and the manufactories of the central West and the East. To an even larger degree, the imports are carried over the Rocky Moun-

tains by rail for distribution throughout the central and eastern sections of the country. This traffic with trans-Pacific countries is large enough to have caused most of the transcontinental railway companies to operate lines of steamers connecting their Pacific ports with the Orient.

The railways that serve our western tier of states derive their traffic from numerous sources; and the indications are that each of the main sources—the industries of the states themselves, the markets of the Cordilleran section, the maritime trade with Mexico, Canada, Alaska, Hawaii, the Orient, and Australia—will contribute an increasing volume of traffic for movement within the Pacific coast states, and across the mountains—to and from the eastern half of the United States. The western railroads have passed the period of doubtful experiment; they rest upon a sure traffic foundation.

The general facts brought out in the foregoing brief survey of the main sources of traffic in the five large physical subdivisions of the United States may be illustrated and their effects noted by a summary tabular analysis of the principal classes of *commodities handled by typical railroad systems* located in different sections of the country. The data presented in the following table are taken from the annual reports of the carriers. The grouping of commodities is that required by the Interstate Commerce Commission.

Classification of Freight Tonnage of Typical Railroads
1908

	Pennsylvania Railroad Co.	Chesapeake and Ohio	Southern Railway	Central of Georgia	St. Paul	Rock Island Lines	Santa Fe
Total tonnage........	182,083,103	16,540,833	26,654,389	4,700,841	26,189,853	15,877,646	16,610,910
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Products of Agriculture	5.94	4.56	11.04	22.39	21.537	26.37	22.88
Products of Animals..	1.78	.69	1.22	1.41	6.894	7.92	7.92
Products of Mines....	65.45	70.79	38.77	24.93	28.518	27.82	32.05
Forest Products......	4.78	10.27	17.76	19.11	12.944	12.26	12.41
Manufactures	18.51	5.99	31.21 (Manufactures, Merchandise, Miscellaneous)	32.16 (Manufactures, Merchandise, Miscellaneous)	17.267	17.92	17.95
Merchandise..........	.77	3.18			12.840 (Merchandise, Miscellaneous)	6.87	6.79 (Merchandise, Miscellaneous)
Miscellaneous.........	2.77	4.52				.84	
Total............	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The sources of the tonnage and the traffic differences of the lines listed in the table are clearly evident. The Central of Georgia, located in the heart of the cotton belt of the South, the Saint Paul in the upper Mississippi Valley, the Santa Fe, and the Rock Island roads in the central and southwestern trans-Mississippi section—the last three systems extending throughout the wheat and corn districts—have a far larger percentage than the other systems do of traffic in agricultural products. Their tonnage of products of agriculture is second only to, and not greatly less than that of mineral products; while the percentage of animal products, in the case of the St. Paul, Rock Island and Santa Fe is from five to ten times that of the other roads.

The percentages for mineral traffic are especially instructive. On all the seven systems, even the two "granger" lines and the transcontinental road, the minerals have a greater tonnage than does any other class of commodities; while on the Chesapeake and Ohio, a prominent soft coal carrier, the mineral percentage is nearly seventy-one. It is evident that the Pennsylvania Railroad, which is the greatest freight carrier in the world, must serve the principal mining and manufacturing section of the United States; 65.45 per cent. of its tonnage consists of minerals, which, together with the manufactures, comprise almost seven-eighths of the company's vast freight traffic. Its coal and coke shipments alone exceed 105,000,000 tons.

The lumber traffic is relatively greater on the two Southern roads than on the others included in the table, because of the large output of the pine and hardwood forests of the Southern States. One-eighth of the tonnage of the "granger" roads and the Santa Fe is lumber, this large traffic being due to scarcity of timber in the prairie states, which are obliged to secure nearly all of their lumber from a distance.

The percentage of manufactures in the traffic of the southern and western railroads is a significant fact. Roads located as the Pennsylvania is will naturally have a maximum tonnage of manufactures, and a coal road, like the Chesapeake and Ohio, a minimum; but the systems which serve regions whose industries until recently, were almost exclusively agricultural, report their tonnage to contain a relatively large percentage—and it is an increasing one—of manufactures. While there are conspicuous instances of the concentration of certain industries in specially favored localities, the evolution of industry in the United States is spreading mills and factories

generally over the country. Cheap and efficient railway transportation makes possible the concentration of industry when that is most economical, and it also enables manufactories to be started in hundreds of places where they otherwise could not exist. The progressive diversification of industry throughout the United States is enriching the tonnage of the railroads with an enlarging percentage of the higher and more profitable classes of freight and is establishing a broader and more stable traffic basis for all our railway systems.

DETERMINATION OF THE HEIGHT AND GEOGRAPHICAL POSITION OF MT. McKINLEY

The Society is indebted to Superintendent Otto H. Tittmann of the U. S. Coast and Geodetic Survey for an advance copy of the Report made to him on a determination of the height and geographical position of Mt. McKinley. This work was done as an incident in the survey of Cook Inlet, on which the Survey is at present engaged. The Report, which is signed by Mr. William Bowie, Chief of the Computing Division, is as follows:

"I have the honor to report that the computation and adjustment of the horizontal and vertical angles to determine the geographic position and elevation of Mt. McKinley, Alaska, have been completed. The resulting position for that mountain, on the Valdez Datum, is

N. Latitude	63°	03′	56.83″
W. Longitude	151	00	41.31

The Valdez Datum is based upon the value of the longitude at the astronomical station in the town of Valdez and the mean of the latitudes observed at three astronomical stations in Prince William Sound, Alaska, and is the datum upon which are based the Coast Charts between Cape St. Elias and the Alaskan Peninsula.

"The resulting elevation of Mt. McKinley above mean sea level is 20,300 feet.

"The above position was obtained from the adjustment of horizontal directions observed from four stations of the Cook Inlet triangulation, three of which were occupied in 1909, while one was occupied the previous year. All of the observations were made by the party under Assistant H. W. Rhodes, commanding the U. S. Coast and Geodetic Survey Steamer McArthur. The angle subtended

at Mt. McKinley was 15° 08′ and the correction to any one direction, as given by the adjustment, was not greater than 11″. It is seen from this that the geographic position is well determined. The nearest point from which the mountain was observed was 204 kilometers (127 miles) while the farthest point from which it was observed was 302 kilometers (188 miles).

"Having found the distance from certain stations to the mountain, its elevation was determined from vertical angles taken at Race Point and Little, two of the stations from which horizontal directions were observed. The two values of the elevation of Mt. McKinley obtained from them are 6179.7 meters and 6194.3 meters. The weighted mean of these two elevations is 6187.5 meters or 20,300 feet. This value is identical with the mean value previously adopted by the U. S. Geological Survey which has superseded the value 20,464 feet given in the Dictionary of Altitudes, published by that Bureau in 1906.

"The coefficient of refraction which was deduced from the observations made in 1894 to determine the elevation of Mt. St. Elias was used in determining the elevation of Mt. McKinley. Its value is 0.083. It was believed to be nearer the truth than the coefficient which was determined from the reciprocal observation made in Cook Inlet in 1909, because those observations were made almost entirely over water, while the lines of the two mountains (Mt. St. Elias and Mt. McKinley) were, for the most part, over land and ice.

"It is believed that the value, 20,300 feet, for the elevation of Mt. McKinley is correct within 150 feet."

THE RETURN OF HALLEY'S COMET

The Weather Bureau of the Manila Observatory has printed a paper* on the return of Halley's comet and the alarm manifested in some quarters over the information that, on May 18-19 the earth will pass through the tail of the visitor. The paper is very instructive and also a plain exposition of the groundlessness of fear with regard to comets in general and particularly as concerns the present return of Halley's comet. The more important information it contains is presented here.

*The Return of Halley's Comet and Popular Apprehensions. By Rev. George M. Zwack, S. J., Secretary of the Weather Bureau. 22 pp. Manila Bureau of Printing, Manila, 1910.

Comets do not differ essentially from the sun and the planets. They are composed of matter such as we are accustomed to and are subject to gravitation and other physical laws. Halley's comet, in particular, is an old acquaintance for it revolves around the sun like the earth and is therefore visible at intervals. Its path is very eccentric and of vastly greater length than that of our earth, so that it needs over 76 years to complete one revolution; but this does not alter the truth that it belongs to the group of cosmical bodies that revolve around our sun. About 75 comets are known to move in elliptical orbits around the sun, some 15 of which have periods of revolution exceeding 100 years, though many others have much shorter periods.

There is also a vast number of comets that are seen only once because their orbits are parabolic or hyperbolic-curves whose branches separate farther and farther. They whisk around our sun at tremendous speed that carries them beyond its controlling force; and passing out into boundless space again they doubtless fall at last under the dominating influence of some sun and become members of its solar system.

From the earliest times to the present, about 700 comets have been recorded of which only about one-fifth were visible to the naked eye. As many as eight have been found in a single year—five in 1909. Such remarkable specimens as the great comets of 1858 and 1882 are rare, nor are they those, as a rule, that approach nearest the earth.

These comets have had their periods of revolution changed, by the attraction of the earth, by amounts measured by weeks, but the earth's even course through the heavens has not been at all affected by the comets. Lexell's comet in 1770 came within 1,520,000 miles of the earth, which was probably the nearest approach; but no effect whatever upon the earth could be detected.

Comets are exceedingly large, but they are also exceedingly flimsy. The head of Enke's comet (which is not a large one) has a diameter of 300,000 miles when it first becomes visible. This diameter diminishes as the comet approaches the sun. The tails of comets are rarely less than 10,000,000 miles long. If these immense bodies had the density of our earth, the effect of their attraction upon the motion of the earth would be very appreciable; but not the slightest effect can be observed. Not one of these comets can have weighed even one two-hundred-fifty-thousandth part of the earth. A comet 40,000 miles in diameter would probably have a mean density of a little less

than one nine-thousandth of that of the air at the earth's surface, or much less than has the residual air in a vacuum tube exhausted by the best air pump. There is no danger that the earth will ever be thrown into new and disastrous paths by the attractive force of a comet.

But is there not danger that some harmful matter may stream into our atmosphere, suffocating every living creature or setting the earth on fire? It has been figured out that, on May 18-19, this year, our earth will probably come within the tail of Halley's comet. The head of the comet will, on that day, be at its closest approach to the earth, over 13,000,000 miles away. But the earth will be mixed up with the tail and what will be the result?

One thing is certain and that is that comets, as a whole, are not luminous by incandescence. The spectroscope tells us that their light is, in part, reflected sunlight, but there is also an emission spectrum which reveals the presence of some gaseous carbon compound that may be cyanogen or some hydrocarbon, if not both. The facts collected have made it perfectly evident that there can be no danger that the comet's tail can set fire to the earth or to its atmosphere.

But what about the gases constituting the tail and their effect upon life? Cyanogen is mentioned as probably a constituent part of comets and it is a poisonous gas. Assuming that the tail is formed of gas or other ponderable matter, some cyanogen, if it is present, would, no doubt be picked up by the earth and remain in the atmosphere. Now as the whole comet is, in mass, perhaps equal to our atmosphere and as the earth would come into contact with only a very small part of it, the head of the comet being 13,000,000 miles away, the quantity entering our atmosphere would be far less than 0.00000001 of 1 per cent. One hundred thousand times this amount would be absolutely harmless, no matter what the gas might be.

However, the argument best calculated to dispel all apprehensions regarding the passage through a comet's tail consists in the fact that the thing actually happened less than a half century ago. According to several astronomers of repute, the earth traversed the tail of the great comet of 1861 at 6 o'clock and 12 minutes a. m. on June 30, 1861, some 300,000 miles within it, and approximately two-thirds of its entire length from the head. Nothing was noticed except a faint luminosity, resembling the zodiacal light, which was seen in the evening of that day. "It is perfectly clear, from all the data known, that Halley's comet, at least at its present return, cannot possibly do

any mischief by either tumbling into the sun or colliding with the earth. Its least distance from the former will exceed 54,000,000 miles; from the latter it will be 13,000,000 miles. As comets have passed unscathed as close as 750,000 miles from the sun, there can be no danger of the present comet falling into it."

The writer then discusses the question of the possibility of the collision of a comet with the sun or our earth. None of the periodic comets is likely ever to fall into the sun unless it be Enke's comet. The period of this small comet (nearly 3⅓ years) is continually shortening, first by 2.5 hours a revolution, but since 1868 by only half that amount. If this state of affairs continues indefinitely, the comet will finally fall into the sun. But there is no prospect of this for many thousands of years. Even if the acceleration of its degree of speed should continue at the present rate, the comet's nearest distance from the sun (perihelion distance), 4,500 years from now, would still be ten times as great as that of the comet of 1882 which passed the sun in safety.

It is different with the non-periodic comets. It is very improbable but still possible that, sometime, one of these wanderers will collide with the sun. The late Prof. Charles A. Young expressed the view that if a comet should actually strike the sun, no harm would be done. Of course, an enormous amount of heat would be generated but, in the opinion of this astronomer, the cometary particles would pierce the photosphere and liberate their heat mostly below the solar surface simply expanding the sun's diameter slightly, and so adding to its store of potential energy about as much as it ordinarily expends in a few hours.

The chances of a collision between a comet and the earth are less than of a comet falling into the sun, so far as relates to comets with non-elliptical orbits, since the diameter of the earth is less than 0.01 that of the sun. It is vastly different, however, with the periodic comets. "The orbits of several of them pass closer to the earth's path than the semi-diameter of their heads. Therefore, provided both the earth and the comet last long enough, the two bodies are bound to come together. But such encounters are extremely rare. Babinet estimates that their likelihood is about one in 15,000,000 years."

The author speaks of the possibility of a collision of the earth with a periodic comet but adds the qualification, "provided both the earth and the comet last long enough." This reservation was suggested by the history of the small comet discovered in 1826 by Biela.

It was a small comet with a period of 6.6 years and its orbit came within a few thousand miles of that of the earth. If they had ever arrived simultaneously at the point of least distance, the earth would have passed through the outer portion of the comet's head. But the comet failed to last long enough. On its third return in 1846, the comet divided into two parts while in full view. When the parts were seen again in 1852 they were about 1,500,000 miles from each other. Since then they have not been seen though they should have reappeared no less than eight times. On the night of Nov. 27, 1872, while the earth was passing the path of the old comet, she encountered a magnificent display of meteors. Similar displays were seen at the usual period of the passage of the comet, in 1885 and 1892.

Of course the nuclei of a comet cannot be solid, for they expand and contract by many thousands of miles. But if the earth were bombarded by the combined energy of the meteors forming the head no living being could survive the ensuing rise in temperature. The ruin would be far greater if there were a head on collision. This would simply mean the end of the world as far as the human race is concerned.

This is bound to happen, sometime, if the earth lasts long enough and comets do not become extinct. But what are the chances? Arago figured out that the chance of any individual comet striking the earth is as 1 to 281,000,000. But all this is nothing to worry about. It takes infinitely less to snuff out the candle of our life than a collision between the earth and a comet. Science tells us that the end of the world as the abode of life is surely coming—and this is infinitely more certain than that the earth will ever be in collision with a comet.

OUTBURST OF THE PEAK OF TENERIFFE

A volcanic eruption of the Peak of Teneriffe began on Nov. 18 last and continued for several days. The world had almost forgotten that this lofty mountain in the Canary Islands, whose summit is often covered with snow, is an active volcano. Many had believed that its fire were almost extinct. Some evidence of life remained, however, for its crater has often given feeble testimony to this fact. But the history of the Peak shows, just as the records of Vesuvius and Cameroon Mountain have shown, that the complete

subsidence of great volcanic forces cannot be inferred from the fact that long periods of time have separated the several eruptions. Large trees were said to be growing in the crater of Vesuvius when the outburst occurred that buried Pompeii; and the great eruptions of the Peak of Teneriffe, since man began to count them, have been about a century apart.

Mr. John S. Fleet writes in the *Geographical Journal* (Vol. 35, No. 1, pp. 59-61) that the people of Teneriffe were somewhat alarmed for some months, last year, before the outburst, by the unusual frequency of small earthquake shocks. Earth tremors, on some days, were continuous for hours. They were felt most on the northwest side of the island near Icod and to a lesser extent, at La Orotava. Finally, on the afternoon of Nov. 18, the residents of La Orotava heard detonations, like the discharge of heavy cannon, at intervals of a minute or less. Tidings soon came that an eruption had occurred near Garachico where the long, northwestern flank of the mountain descends to the sea. Smoke could be seen rising over the intervening hills, the noise of the explosions was heard all night and, in the darkness, the glow of the red-hot lava was reflected on the clouds.

Next day it became clear that the eruption was really in the vicinity of Santiago, which stands 6 miles west-north-west of the peak. A stream of lava about a half mile wide and 8 feet deep was slowly travelling down the valley towards the village. Thereafter reports arrived that another lava flow was proceeding in a northerly direction towards El Tanque, which lies about 2 miles from Garachico. The rate of advance is variably stated but it must have depended largely on the slope and configuration of the ground.

The length of the lava stream flowing towards Santiago is said to have been about 3¾ miles and it advanced about a half mile in 24 hours. Santiago was not invaded and the stream descending towards El Tanque also came to rest.

Later reports say that the eruption took place on level ground not far from Chahorra which is a large crater to the west of the main summit at an elevation of 10,500 feet. The craters from which the November outpouring of lava came are on a fissure running 15° north of west, at an elevation of only 3,482 feet. Many parties have visited the scene of the eruption and have found it easy to get within 400 feet of the craters. The wind, during the early part of the outburst, was persistently from the south and a cone of volcanic ash, 400 to 500 feet high was formed. Clouds of steam and showers of stone were still being projected into the air, but the lava flow seems to have continued only a few days and had nearly ceased on Nov. 26.

The main facts, in brief, are that a new fissure opened low down on the northwest quadrant of the volcano and that the large amount of lava emitted from it took its natural course down the valley towards the sea. All the other parts of the island were protected from the lava flow by the ring-like crater wall that girdles the base of the mountain. There was no loss of life.

Very likely, nothing more of importance will be heard of Teneriffe as a volcano for a long time to come. The island is so accessible that expert students of volcanic phenomena are almost certain to visit Teneriffe to investigate the latest great outburst. It is fortunate, for purposes of comparison, that the series of volcanic eruptions in the islands of the Canary group, including Teneriffe, in the years 1730-36, was made the subject of extended observation by Leopold von Buch and that he recorded the results, at length, in his classical work, "Physikalische Beschreibung der Canarischen Inseln."

The last previous great lava flow from the Peak of Teneriffe occurred in 1798, 111 years earlier. Chahorra was the active center having superseded the summit crater. Nearly a century earlier, in 1706, a great lava flow destroyed the town of Garachico which stands on the coast, about 7 miles northwest of Chahorra.

The only report we have of an eruption, that evidently occurred in 1492, is a mere mention made by Columbus in his day book, when he was on his first journey to America. He wrote that on the nights of August 21-25 "We saw a great fire springing out of the Mountain of Teneriffe."

THE PARKER EXPEDITION TO MT. McKINLEY*

BY

BELMORE BROWNE

As far as our plans were concerned, the pack horse method of approaching Mt. McKinley from the west and north was eliminated by the failure of the earlier efforts in this direction. We also found that a pack train attack from the Tanana side was out of the question on account of the length of time required. We then had to choose between the winter approach with dog teams, and the southern, or motor boat route.

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*Professor Herschel C. Parker, adjunct professor of Physics in Columbia University, Mr. J. H. Cuntz of the Stevens Institute of Technology, Hoboken, Mr. Belmore Browne, the mountaineer and writer, and Mr. Herman L. Tucker, of the U. S. Forest Service, left New York late in April for Seattle, whence they will sail for Alaska to attempt the ascent of Mt. McKinley and the survey and mapping of a part of the mountain region around it.

In thèory the dog team approach seems to be the best. Travelling over the snow would necessitate leaving the Tanana River in February. The party, reaching the mountain early in the spring would probably be able to drive their dogs to the actual base of Mt. McKinley. With a base camp at a high altitude, the party might then devote several weeks to studying the best route to follow. We, however, were forced to give up this approach as we did not have the time necessary for a winter attack.

We therefore turned our attention to the southern motor boat route on which our plans are based. Entering the Susitna River, from Cook Inlet we will ascend it for over sixty miles in a specially constructed motor boat. On reaching the Chulitna River our party will leave the Susitna and follow the first named river to a point just below the Ruth Glacier. This glacier extends south from Mt. McKinley for 40 miles and forms a broad but rather rough roadway to the big mountain. Our base camp will be pitched at the base of this great river of ice, and from this point we will push our mountain equipment towards Mount McKinley by relays. Our mountain base will be within two easy or one long days' travel of the southern base of the mountain and from here the reconnaissance parties will proceed. This camp will also be the base from which our topographical work will be carried on.

The chief interest of this approach is that no one has been nearer than 15 miles from the mountain on this side. Our party will have the task of locating the great ridges, glaciers, and peaks and mapping them. We believe that the southern face of Mt. McKinley cannot be climbed, and it is swept by avalanches of such size that the very mountains shake under the impact of the thousands of tons of snow and ice that fall from the mighty cliffs. But from our base camp, reconnaissance parties will be able to reach the southwestern and northeastern arêtes and our final attempt will undoubtedly lead along one of these great ridges. For this work we have a mountain outfit unequaled, I believe, in American mountain climbing.

Our tents will accommodate five men and are made of light waterproof material. They have been made to stand the force of mountain hurricanes and are practically wind proof. Our sleeping-bags are necessarily light; but in mountain work the climbers will sleep with their clothes on. The bags consist of a waterproof cover, with a light inner blanket of camel's hair, outside which is a light eiderdown quilt.

In climbing we will use the Swiss braided mountain rope, and, for overcoming the snow slopes, will be provided with both Swiss and English ice axes and ice creepers. The food will be the same as that used in Arctic work: pemmican, erbswurst, raisins, hard-tack, tea and sugar. The only cooking necessary will be the boiling of water for making tea, or soup, and for this purpose we are supplied with alcohol and kerosene stoves.

Our mountain clothing is all wool, and includes hoods, gloves and puttees. As many attempted mountain ascents have failed through members of the party freezing their feet, we will wear three pairs of woolen socks in the higher altitudes. Our mountain shoes will be the regulation hob nailed leather shoe for rock and glacier work, and rubber shoe packs fitted with ice creepers will be worn on the mountains.

For determining mountain altitudes, we shall carry two hypsometers, two self-recording barometers and thermometers, one high altitude mercurial barometer and three aneroid barometers, registering respectively 10,,000, 18,000 and 20,000 feet. Minimum thermometers, thermometers, hypsometers, and pocket anemometers complete the list. For map making we will have the regular topographical instruments.

Our method of travel will be by relays, and when a suitable amount of food is gathered at the base of the mountain, reconnaissance parties will be sent out. There will be many difficulties to overcome in this work. While our object is primarily to climb Mount McKinley, our climbing will really begin 40 miles from the summit, and for the entire distance our equipment must be the same as that actually used on the summit.

On reaching the base of the mountain, we will still be confronted by about 17,000 feet of ice and snow climbing. This is an unusual feature in mountaineering, as on all the high peaks of the Himalaya and Andes the actual climbing begins at a high altitude, and a peak of the same height as Mt. McKinley would only carry about 4,000 feet of perpetual snow.

STUDIES ON CLIMATE AND CROPS*

1. Variations in the Distribution of Atmospheric Pressure in North America

BY

HENRYK ARCTOWSKI

In a memoir recently published I have given the results of a comparative study of the variations of annual mean temperatures.† As a continuation of this study I shall examine, in the present paper, the data of annual mean atmospheric pressures, and to make clear the object of these investigations I shall begin with a short summary of the principal conclusions of my work on temperature. These conclusions are :

1. At a given place any excess or deficiency in a yearly mean temperature affects, in the same way, the whole layer of the atmosphere accessible to direct observations. Moreover, it seems that the variations are more accentuated at high-level stations.

2. The climatological anomalies are regional. For long series of observations the curves of lustra means show that minima of certain regions occur at the same time as maxima of other regions. Most probably the length of the cycles differ in different countries, as also do the successive waves in the curves of each station.

3. In Europe there seems to exist a rhythmical oscillation of the isotherms. Utilizing the results of those stations of France, Germany, and Russia, where homogeneous series of observations exist for the period of years 1851 to 1900, I have made maps showing the distribution of the departures of the means of each of the five decades of years from the general means. These maps show that the departures observed in the east and west are generally opposite. In other words, the temperatures are too low in Russia when they are too high in France, and *vice versa*.

From the above statements, it results that it was necessary to solve the problem of compensations before it was possible to know whether changes really exist in the quantity of heat accumulated in the Earth's atmosphere. For this purpose I collected the mean temperatures, for the years 1891 to 1900, for all the countries where meteorological observations have been pursued during those years. For each station I calculated the mean of the ten years, the annual departures from that mean, and the

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* The author has come to the United States to pursue here his investigations on changes of climate. His first contribution to this subject was his discovery, 10 years ago, of the former great extension of glaciation in the antarctic regions. He is making a systematic study of climatic and crop data with a view of presenting the various factors that may connect astrophysical phenomena with those of commercial geography. His second paper will treat of variations in the yield of wheat in connection with climatic changes.—The Editor.

† L'enchaînement des variations climatiques, Bruxelles, 1909.

difference between the means of the two lustra. In setting forth these figures on maps I was led to the following conclusions :

4. The temperature of the Earth's atmosphere was higher during the lustrum 1896–1900 than during that of 1891–1895. The difference can, of course, only be estimated, and it seems to be between 0.2° and 0.5° C.

5. The year 1893 was the coldest and the year 1900 the warmest of the decade taken into consideration. It seems that the mean temperature for the globe was at least 0.5 C. higher in 1900 than in 1893.

6. The areas of positive and negative departures, on the annual maps, show that most probably dynamical phenomena in our atmosphere cause extremely slow displacement of waves characterized by a deficiency or excess of heat. I have given the name "thermopleions" to the waves of positive departures, and have called "antipleions" the areas where the temperature is below the normal—that is, below the mean of the ten years. The pleions and antipleions, while changing their forms and positions, can be followed in most cases from one year to another.

Now, as 1893 was precisely a year of maximum sunspots and 1900 was near a year of minimum, it seems that the phenomenon of sunspots is in correlation with fluctuations of the quantity of energy radiated by the sun, and also that the first cause of climatological variations is extra-terrestrial. To arrive at a more definite conclusion, I have examined the curve of the monthly mean temperatures noted at Batavia since 1866. This curve shows that, besides the period of sunspots, other periods, of longer or shorter duration, play a more important rôle in the observed changes of temperature.

On the other hand, as we have seen, besides the extra-terrestrial cause on account of which the terrestrial atmosphere, considered as a whole, does not remain constant, other factors, of a purely geographical order, modify the distribution of excess or deficiency of received radiated heat to such an extent that in the study of observed variations these factors must first be considered.

Leaving, therefore, for the moment, the correlations between the sun and atmos pheric phenomena and the manner of formation of the thermopleions, I shall try to make plain the mechanism of the propagation of these changes of temperature.

The established facts show that in all probabilty this propagation is essentially due to changes in the atmospheric circulation. Some of these changes may be rhythmical,* others may be periodical† or progressive. We should know, therefore, the modifications of the velocity and direction of the wind. The anomalies occurring in the distribution of atmospheric pressure may, however, serve as a first approximation. Such anomalies exist even if we take into consideration the departures of lustrum means, as I demonstrated in a paper published over a year ago.‡ In the present paper I shall examine more in detail the annual departures of pressure noted in the United States.

Two hypotheses formulated on the subject of the variations of atmospheric pressure have attracted much attention. According to the first hypothesis, the baro-

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* The diagram of the yearly resultants of the direction of the wind at St. Petersburg which I published in my study on the changes of the climate of Warsaw (*Prace matematyczno fizyczne*, *1908*) may be cited as an example.

† Such seems to be the case with the wind velocity on mountain-peaks. (Arctowski in *Bull.* Soc. belge d'Astronomie, 1907.)

‡ *Comptes Rendus* de l'Acad. d. Sciences de Paris.

metric gradients between areas of low and high pressure, as well as the ranges of annual variation, increase and decrease progressively during periods of about 35 years. Under the second hypothesis, the climatic anomalies of western Europe are explained by temporary accentuations or diminutions of the Atlantic "centers of action."

It is sufficient to look at the map of annual isobars in Bartholomew's Atlas, which has been reproduced in many publications, to see that the high-pressure belt of the northern hemisphere crosses the United States, and that toward the north, in Canada, along the axis of the continent, an area of high pressure completely separates the Atlantic and Pacific "centers of action" of low barometric pressure. It is evident, therefore, that if really, under the influence of solar phenomena, for example, the atmospheric pressure increases in the region of Iceland, and at the same time diminishes at the Azores, or *vice versa*, and especially if the same thing happens in the same way at the "centers of action" of the Northern Pacific Ocean, the data of the American stations, entirely comprised between these four "centers of action," will give most important information.

I pass now to the main object of this paper.

Utilizing the data collected by Sir Norman Lockyer*, I have inserted on maps the annual departures, from the general means of the years 1876 to 1900, for the following stations:

Jacobshavn, Berufjord, Stykkisholm, Tromsö, Aalesund, Brussels, Ponta-Delgada, Lisbon, Madrid, Aberdeen, Valencia, Duluth, Denver, Galveston, Montreal, Toronto, Washington, Nashville and Mobile.

An important fact to be noted in regard to these maps is the range of possible variations. At Tromsö, for example, the highest mean was in 1897, and the lowest in 1887. The difference between the two values in thousandths of an inch is 0.220. The following figures give, in the order of the stations mentioned above, the corresponding greatest differences:

0.166, 0.220, 0.212, 0.220, 0.169, 0.098, 0.144, 0.136, 0.121, 0.158, 0.203, 0.093, 0.054, 0.096, 0.113, 0.087, 0.089, 0.082, 0.069.

It is only in Lapland, Iceland and Ireland, therefore, that the differences are higher than 0.200, while in the United States the possible range is less than 0.100. It is found, by placing these figures on maps, that the curve embracing the differences higher than 0.150 extends from Denmark toward Scotland, passes downward by the Bay of Biscay into the neighborhood of the Azores, then up again toward Labrador. The curve of the differences 0.100 takes in Spain and the Azores, then mounts toward Canada. In North America the atmospheric pressure varies between much narrower limits than on the Atlantic, and the axis following which the anomalies may be greatest forms an arc, which starts at the high-pressure belt of the Azores and tends toward the North Cape, passing south of Iceland. These facts permit us to presume that the anomalies in the distribution of atmospheric pressure, in the United States, may be directly influenced by those of the Atlantic, as well as Europe may be influenced by them. The annual maps I have traced from the figures of Lockyer's tables in no way contradict this supposition. To get a clear idea of the exact state of things, I supplemented Lockyer's figures by the annual departures published by Frank H. Bigelow, in his report on atmospheric pressure in the United States, and those of the summaries of the *Monthly Weather Review*.

A first approximation is furnished by a detailed study of the data of Table 55 in Bigelow's memoir. Bigelow has subdivided the data of 202 stations in the United

* Monthly Mean Values of Barometric Pressure. London, 1908.

States into groups, and has formed for each group the mean departures for the years from 1873 to 1899. In this way the following table has been formed:

	N. ATLANTIC.	S. ATLANTIC.	LAKE REGION.	W. GULF.	N. PLATEAU.	S. PLATEAU.	PACIFIC.
1876......	—0.020	—0.002	—0.012	+0.007	—0.020	+0.003	0.
77......	+ 5	—10	+11	+ 2	— 8	— 9	—12
78......	—67	—56	—51	—49	—28	—25	—31
79......	+10	+17	+10	+ 7	—24	— 9	— 4
1880......	+21	+25	— 6	+13	— 7	— 8	+19
81......	— 8	—14	+ 2	—15	— 4	—13	— 1
82......	+20	+13	+ 7	+ 1	— 4	— 1	+ 7
83......	+31	+18	+15	+15	+18	+11	+16
84......	— 1	— 8	+ 2	— 6	— 7	— 5	—27
85......	—33	—31	—20	—12	— 5	+ 8	—15
86......	— 6	—13	0.	— 9	0.	+ 5	— 2
87......	— 1	— 2	+ 1	— 5	— 6	— 1	+ 1
88......	— 1	+ 4	+24	+ 8	+11	+ 4	—16
89......	—11	—12	+ 8	+ 6	+16	+22	—15
1890......	— 1	+12	+12	+11	+14	+20	+16
91......	+15	+ 6	+ 7	+ 1	— 7	— 5	+ 3
92......	— 8	+ 6	+20	+ 4	+ 8	+ 2	+ 6
93......	—16	—19	—32	—21	—18	—12	+ 9
94......	+17	+ 9	—12	+12	— 5	+14	+ 8
95......	— 8	— 7	—10	+ 6	+10	+12	+ 8
96......	+10	+15	+ 6	+ 9	+ 5	+ 8	— 4
97......	+ 8	+ 2	+11	0.	+12	+ 6	+ 7
98......	— 3	— 1	—11	— 3	+12	+ 1	— 1
99......	+11	+ 4	+ 2	0.	— 4	— 3	+ 1

The maps I have drawn with the aid of these figures are most instructive. I take at random those of the years 1888, 1889 and 1890.

The map of 1888 shows that the greatest excess above the normal pressure has been noted in Wisconsin. From this center of hyperpressure the figures diminish towards the Atlantic and Pacific, and, on both sides, in the N. E. and in California, the departures are negative. Drawing the curves of equidepartures for the three years considered, maps are obtained which show that the area of hyperpressure maintained itself during those years, and that its center moved progressively from the Lake Superior region towards the Gulf of California. The highest positive departures for those years are but 0.024, 0.022 and 0.020. This is a matter of small excess in the atmospheric pressure. However, if these figures be compared with the possible range of values, deduced from the differences between the highest and lowest observed means (observe that the departures have been lessened by the fact that they represent the means of a certain number of different stations), it is conclusive that here is a phenomenon which might play an important part in the climatological variations occurring in North America.

The fact of a displacement from N. E. to S. W., which has been established by the preceding example, is not exceptional. On the contrary, an examination of the maps drawn with the aid of Bigelow's table shows the important fact that the areas of excess or deficit pressure generally move from the E. towards the W., from the Atlantic towards the Pacific. In 1877, for example, there was a center of hyperpressure over the Lake region. In 1878 the pressure was abnormally low over the entire United States; still, the wave of hyperpressure seems to have maintained itself, moving westward meanwhile, because the least negative departures are to be found in the plateau region. The figures are—0.028 and—0.025 against—0.067,

which is the mean of the departures of the northeastern stations. Further, this extraordinary minimum, notably lessened, is observed in 1879 in the N. W., and seems to have been pushed there by a positive wave coming from the Atlantic. The

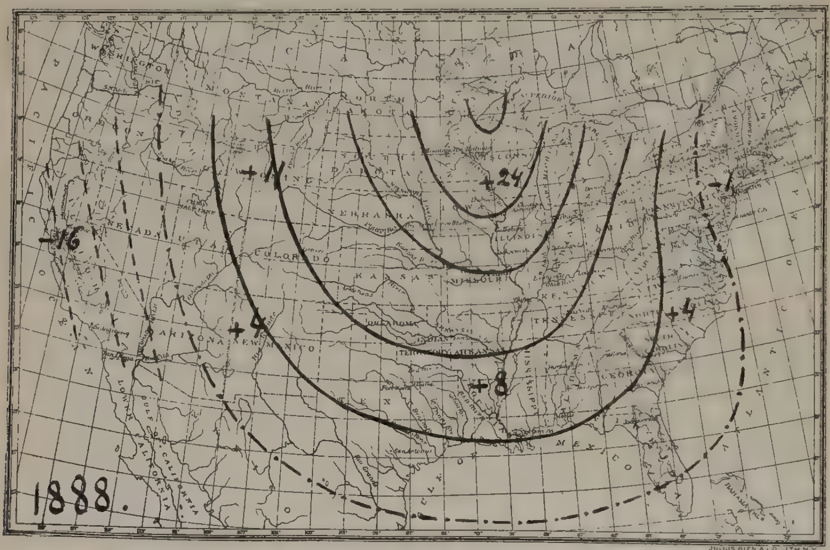

FIG. 1.

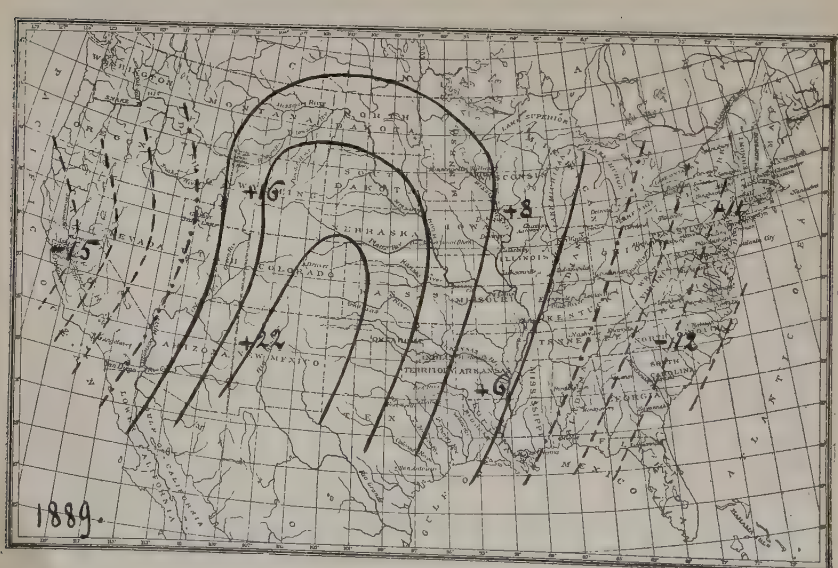

FIG. 2.

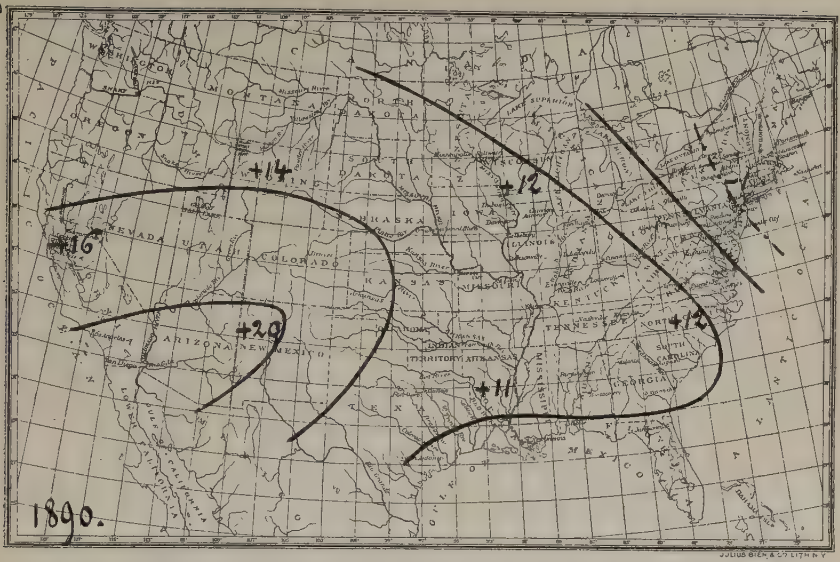

FIG. 3.

maps of which I speak can easily be drawn by using the figures of the above table. I will not dwell longer on this, inasmuch as these maps should be considered suggestive rather than demonstrative.

In order to understand the dynamical phenomena better, I have drawn more detailed maps by using the departures of the different stations. For the maps of the years 1876 to 1899 I have used the figures of Bigelow's tables, and for those of 1897 to 1908 I have used those of the annual summaries of the *Monthly Weather Review*. These maps show that in reality the changes in the distribution of pressure are extremely complicated, and that to thoroughly understand the displacements of maxima and minima which appear from year to year it is necessary to utilize the figures of all available stations. Insufficient comparisons can only lead to vague conclusions, and the real extent of practical conclusions that one has a right to look for, from a deeper study of this subject, is so great that a serious effort to completely solve the problem is justified. The principal difficulty in accomplishing this is the fact that the available figures are far from being perfect.

The maps made from using the departures calculated and published by the Weather Bureau contain many errors which are inevitable, because the departures are taken from means of more or less long series of observations. It is impossible to eliminate this lack of homogeneity if one wishes to use all available data. Then, too, in most cases the stations have been moved from one place to another, some of them several times. Therefore, the corrections which have been applied to render the series homogeneous may have been wrong.

That it may be better understood, I give an example to show the difficulties one has to deal with when the figures are inscribed on the map and one tries to draw the curves of equidepartures.

The departures given for Davenport for the years 1891 and 1892 are, respectively, + 37 and + 51. Those of Dubuque, Chicago, Springfield and Des Moines are, for 1891: + 7, + 10, – 4, – 3; and for 1892: + 16, + 12, + 4, + 4. So the departures of Davenport cannot be taken into consideration.

Even a better example is furnished by the departures + 32, + 20 and + 52 given for Pittsburg for the years 1892, 1893 ane 1894. The maps show us that in reality, instead of the preceding figures, the departures should have been about 0, – 25 and + 5. On the other hand, the map obtained for 1899 by using the figures in Bigelow's tables differs obviously, in many details, from that one made with the figures of the *Monthly Weather Review*.

I am aware that the figures cannot be quite exact, the causes of error being many and various; still, it is worth while to note the fact that the departures are only approximate in order not to draw too many conclusions from a study of the maps.

The study of the geographical distribution of the departures suggests that at each point the phenomenon of the variation of annual pressure is governed by the passage of waves having different centers of origin. To study in a really scientific manner the direction and the velocity of the displacement of these waves, as well as the phenomenon of interferences which must occur, the maps that I have been able to draw are insufficient. But, nevertheless, they are suggestive; moreover, all the particularities can be studied, and all the deductions to which a comparison of the maps lead, may be verified, by using a method of research which I shall outline further on.

There is another point which, notwithstanding its evidence, should especially be noted. The real signification of the fact that an annual mean of the atmospheric pressure is slightly too high or too low cannot be defined. An annual mean may be too low owing to an exceptionally low monthly mean. This monthly mean of a certain locality may be abnormal because of a single barometric depression. This depression will only have influenced the means of stations along its path. On the other hand, there is all the complexity of the seasonal changes of pressure which should be discussed.

Therefore, as the maps suggest the existence of waves whose propagation is so slow as to take two or three years to cross the United States, from the Atlantic to the Pacific coast, it would be most interesting to know how far these waves are independent or, on the contrary, affect the seasonal distribution of atmospheric pressure. Before entering into the details of the suggestions to which the study of the maps give rise, I wish to show by a typical example that without any doubt, in certain cases, we have to do with a phenomenon of propagation of atmospheric waves.

The maps of 1891, 1892 and 1893 show the displacement of a maximum whose center, in 1891, was on the Atlantic, N. E. of the New England States; in 1892 it had reached the States of Wisconsin and Minnesota, while in 1893 it had moved on, beyond the Rocky Mountains and Pacific Coast, to the west of San Francisco. This maximum was followed by a very characteristic minimum, whose centre was in the N. E. in 1892, where there had been a maximum the preceding year, and in 1893 the center of most negative departures was over Lake Michigan. As the year of our calendar is quite conventional, one may ask whether the same facts would result from annual means whose year began, for instance, in October, or any other month.

Since it is a question of the displacement of a wave, it is necessary that the crest of this wave, or the hollow which follows it, should pass successively over the localities situated in its path.

In order to make sure that it is allowable to theorize on the tracks followed by the centers of hyperpression shown by the maps, I have taken the trouble to calculate the

consecutive means for the following stations: Eastport, Boston, Buffalo, Detroit, Grand Haven, Green Bay, Duluth and Moorhead. The curves of the following figure graphically express these means.

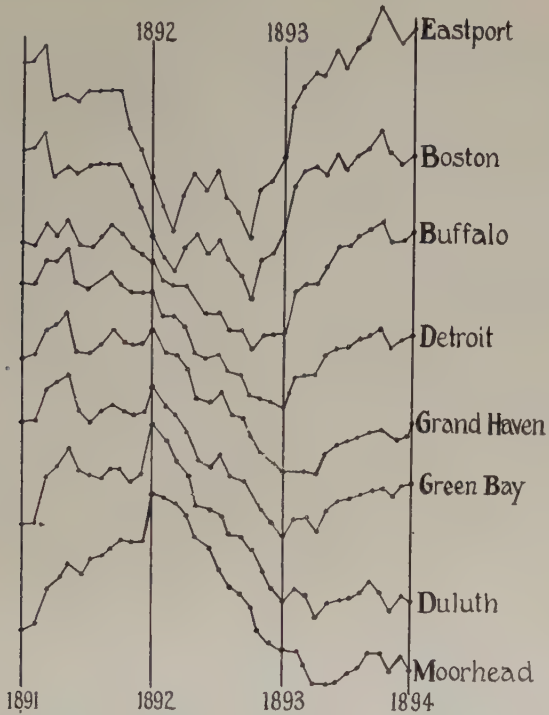

FIG. 4.

Each one of the points of these curves represents the value of an annual mean. The first, of each curve, is given by a mean barometric height for the months January to December, 1891; the second expresses the mean of the months February, 1891, to January, 1892, and so on. It is certain that the curve of Boston is not repeated in all its details.

The wave changes its form as it advances. It is quite plain, however, that the maximum which was observed at Boston as the mean of the months from March, 1891, to February, 1892, and at Detroit as that of the months May, 1891, to April, 1892, does not pass by Moorhead until the months from January to December, 1892. The curves of Buffalo, Detroit and Grand Haven show very plainly the displacement, from E. to W., of the minimum of the variation: October, 1892, to September, 1893; January to December, 1893, and March, 1893, to February, 1894.

It would be easy to give other examples not less characteristic; still, I think that the example given is sufficient to show that my maps do not lead me into error, and that I can confidently go ahead with the examination of several questions of detail. I reproduce below two of the maps I have drawn. They are those of the years 1907 and 1908.

The departures of the *Monthly Weather Review* are given in hundredths of an inch. Thus, the figure 5 on my map means 0.05 or 0.050. Such an approximation is not sufficient; the departures ought to be given in thousandths of an inch.

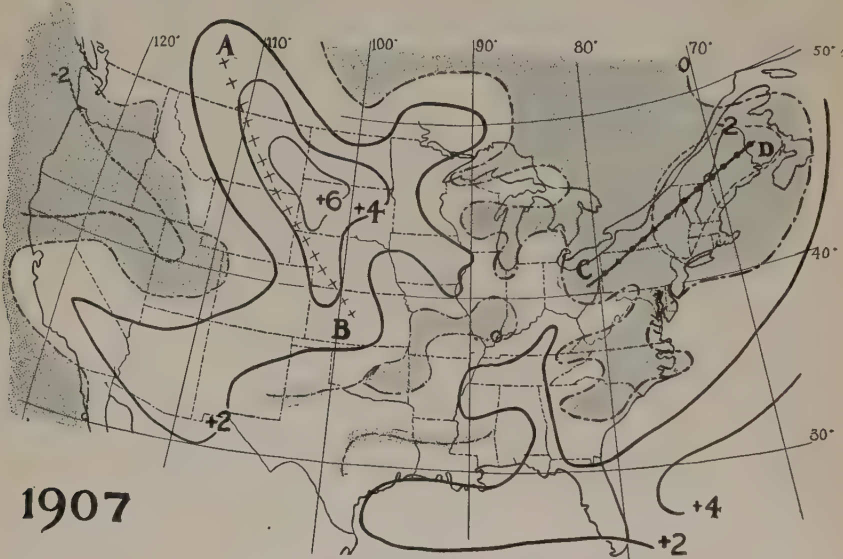

FIG. 5.

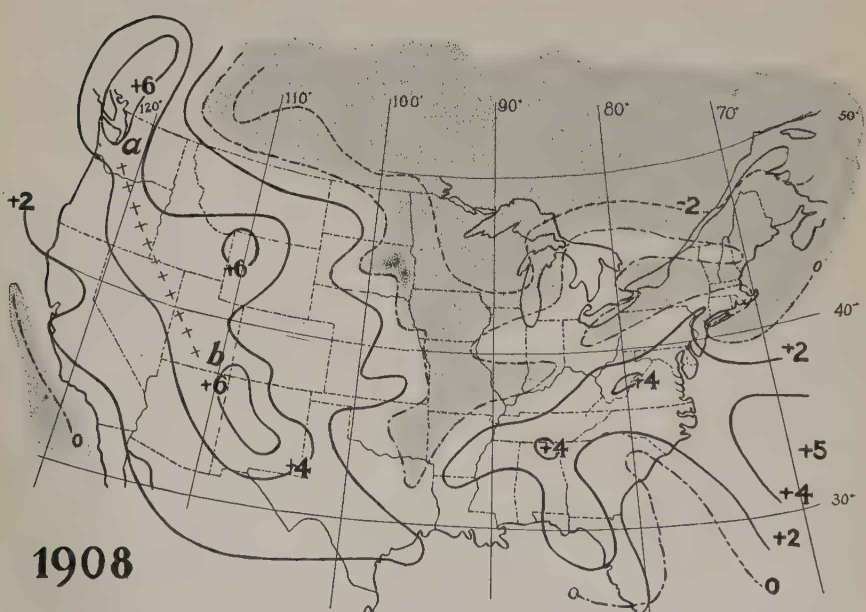

FIG. 6.

When the figures are written on the maps one remarks immediately that the departures of certain localities are doubtful. For example, the figures -4 and 0 given for Red Bluff. It is perfectly possible, however, that the number of departures which are wrong is more considerable than the maps seem to indicate, because certain details of the curves are incorrect.

The wrong departures could easily be found and corrected by using the method of consecutive means. In the same manner it would be possible to verify the accuracy of the details of the curves. When such maps shall be used for forecasting, these corrections and verifications should be made.

The maps for the years 1907 and 1908 are sufficient to show, in an absolutely indisputable manner, that the problem of forecasting the abnormal distribution of atmospheric pressure several months in advance is at present practically approachable.

To make the matter plain, I have drawn some lines which indicate the direction of the waves. The positive wave *AB*, of the map of 1907, seems to have taken the place *ab* in the following year. If this wave maintains itself longer, and if its displacement goes on westward, it will be on the coast, or on the Pacific Ocean, that the axis of highest positive departures shall be found on the map of 1909. A forecast made in this manner would be similar to the weather forecasting made daily by the different weather bureaus. However, a forecast made this way would be arbitrary and as full of uncertainties as forecastings of the weather are.

There is, indeed, another line which the preceding one crosses. It is the negative wave *CD*, on the map of 1907, and while the wave *AB* gives the impression that it moved toward the S. W., the wave *CD*, on the contrary, seems to have moved toward the N. W. or the N. There are, then, to all appearance, two distinct simultaneous movements. But if we imagine two waves, both positive, directed one from the N. W. toward the S. E. and the other from N. E. to S. W., one moving toward the S. W. and the other towards the N. W., the knot formed at the point of intersection will move exactly from E. to W. if the velocity of the displacement of both waves is the same, or following a direction between N. W. and S. W. if the velocity is not the same, or even in one of these directions in the special case that one of the waves is stationary. To well understand how the particularities of the map of 1907 were progressively transformed into those shown on the map of 1908 it would be sufficient to draw the eleven maps of consecutive means, which may be slipped between the maps we already have before us.

The map of 1909 as well, so that the means of each month could be utilized as they come. In this way it would be easy to follow the transformations which take place. Let me say again, that my maps show that the problem of forecasting the anomalies of distribution of pressure is approachable at present. It is this particular problem which is approachable, not the forecasting of the change of climate. From the point of view of this remark it is necessary to understand well what the maps of the departures represent.

They give us indications on the abnormal inflexions of the isobars,—their oscillations. The same departure observed in different places may produce a very different effect. A given departure, let us say negative, may signify a greater abundance of cold winds, or rainy winds, in a certain locality and precisely the contrary in another place.

Then, on the other hand, it is necessary to know the season of the year during which the maximum of the deviation occurs. This last point, however, necessitates a series of investigations before it can be taken into consideration. For the time being I am forced to restrict the field of my researches. I can only examine the annual means, because I am obliged, in the first place, to pass in review generalities

concerning the tendencies of variation. It is only in this way that it will be possible to get at the results without becoming bewildered.

If we look now at the special questions which present themselves we must begin by saying a few words on the velocity of propagation of barometric waves. The maps show that sometimes the anomalies of atmospheric pressure succeed each other rapidly during several years, while other groups of years are characterized by similar situations or by a very slow movement of the areas of positive or negative departures. A study of the diagrams published in the report of Sir Norman Locker forces us to admit that in other countries the same phenomenon can be observed, for there are numerous localities where, sometimes, during several consecutive years, the annual means have nearly the same value. From this point of view, the maps which I have drawn from the departures published in the *Monthly Weather Review* can serve as an example.

The positive wave directed from N.W. to S.E., across the plateau region, on the maps of 1907 and 1908, maintained itself from 1903, only undergoing slight oscillations either toward the E. or the W. Moreover, a stationary situation of this kind must be very exceptional.

From their appearance, the maps drawn can be classified as follows:

(a) Indefinite situation (1896, for example); (b) contrast between the N. and the S., —curves of equal departures directed from E. to W. (1894); (c) a center surrounded by nearly circular curves covering the entire United States (1893); (d) curves directed in such a fashion that the map gives the impression of the existence of intersecting waves. This is most often the case.

Although it is prudent not to draw too many conclusions from the stated facts, yet I wish to mention a few suggestions which follow from the examination of the maps.

In the first place, since this is a phenomenon which, in most cases, acts as if it were a wave movement, it is quite natural to compare the departures observed in the United States with those noted in Iceland, Greenland and on the Atlantic coasts of Europe.*

One wonders if the waves do not originate in the region of Iceland—if the center of the disturbances is not located there. For there is certainly a correlation between the departures noted in Iceland and those of eastern Canada and the Atlantic States. Generally the departures are of opposite character.

To illustrate this fact, I transcribe some annual departures from the general means of the twenty-five years 1876 to 1900:

	BERUFJORD.	MONTREAL.	WASHINGTON.
1876	+ 39	—29	+ 3
77	— 28	0.	+14
78	+ 98	—70	—55
1881	+ 63	—16	— 8
82	— 55	+28	+26
83	—110	+43	+34
84	—118	—13	+ 3
1890	—122	+ 7	0.
91	— 67	+20	+13
93	+ 43	— 9	—18
94	— 39	+13	+ 3
95	+ 91	—12	— 9
98	— 67	+30	— 5

* I have compared the curve of Stykkisholm with that of Ponta Delgada and have formed the curve expressing the differences between the mean pressures observed in these two localities. In most cases the years of exceptional high pressure in Iceland are years of exceptionally low pressure in the Azores. No kind of periodicity is apparent, and it seems that the changes in the pressure observed in the United States do not depend on the differences in question.

I have only chosen typical cases. Other years offer situations quite as interesting. For example, in 1887, 1888 and 1889 the departures observed in Iceland and in the Azores are of an opposite character, and the distribution of the different values of the departures, noted in the United States, is such that it is perfectly legitimate to admit that a considerable part of North America belongs to the waves comprising Iceland and Greenland.

The departures for 1896 and 1897 give us examples of another kind. In both years the predominance of positive departures is such that the compensations must be looked for outside of the regions taken into consideration.

Whatever it may be, the correlation, bearing the character of a seesaw, existing between Iceland and North America, is without any doubt more typical than that between the mean pressures of Cordoba and Bombay, a correlation on which W. F. S. Lockyer strongly insisted.

The initial point of the above statement was the question whether the anomalies observed in the United States take their origin in the region of Iceland, and if it is from there that they spread. It is too soon to affirm it with certainty, because the question necessitates very elaborate discussion. It seems to me that the phenomena of compensation noted are sufficiently remarkable to justify a special investigation of this kind. I intend to enter upon this study later on, when I shall be able to take into consideration the data from all the regions of the globe.

I pass now to the question of periodicity. The question presents enormous difficulties. The maps expressing the distribution of the departures force us to admit that the curves representing the succession of mean values of atmospheric pressure do not permit us to affirm or contradict the existence of certain periods of variations.

If the variations always originated from the same points of the globe, and if from there they would always propagate in the same manner and with uniform speed, the curves of the different localities would represent an immediate repercussion of given oscillations. But such is not the case, and it seems that no curve from any locality can be considered as being individual. Moreover, no departure is independent of the values observed the same year, or observed before at other places.

Therefore, the question of periodicity must be approached in an indirect way. I have examined the variations of the amplitudes of the waves noted on the detailed maps—drawn from Bigelow's figures. At first sight it seems to be the same question as that of the differences between the annual means of Stykkisholm and Ponta Delgada. It is not so, simply because it is not necessarily in Iceland and the Azores that we observe every year the largest departures. To know where the greatest departures occur, and their values, a detailed map is necessary.

The maps drawn for the United States show that the departure — 0.025 observed in St. Vincent, in 1891, is probably correct, and that the figure + 0.023 noted at Portland and Eastport is also correct. The difference of these values is 0.048. It is the maximum amplitude of the waves, inasmuch as there may be a question of annual waves.

The following figures have been obtained in the same way for the years 1891 to 1899:

48, 66, 67, 71, 66, 62, 58, 54, 49.

The amplitudes increase, in consequence, from 1891 to 1894, and decrease from 1894 to 1899. If one considers the curve expressing the frequency of sunspots, the preceding figures become so significant that I think I may affirm that we have again to deal with a new question which should be examined separately.

The amplitudes of the waves give a measure of the principal agent of the dynamical phenomena which regulate the whole system of variations.

I conclude, therefore, by saying that the examination of the annual means of atmospheric pressure observed in the different localities of the United States confirm the principal result of my researches on the variations of the annual means of temperature. That is to say, there exists a dynamical climatology, and the study of the dynamics of climates is perfectly possible.

GEOGRAPHICAL RECORD

AMERICA

MR. JOCHELSON'S FINDS ON ATTU ISLAND. The departure of Mr. Waldemar Jochelson and his wife for the Aleutian Islands, for ethnological studies, was reported in the *Bulletin* (Vol. 40, 1908, p. 753). Some details of his work on Attu Island, the most eastern of our Aleutian possessions, are printed in *Globus* (Vol. 97, 1910, p. 99) from a short report he has sent to St. Petersburg. He has made many excavations and found numerous dwelling places affording much evidence as to the development of material culture among the ancient Aleuts. His collections number 250 specimens, among which are many stone and bone carvings, 13 skulls, a complete skeleton, stone and bone lances and arrow heads, and baskets and other objects woven by women from grass. This grass weaving shows great skill and fine technic. He has also specimens of edible plants and roots, fibers, and 50 phonographic cylinders on which he took folk lore and songs of the Aleuts. He has written his descriptive text, secured a large vocabulary and prepared a grammar of the native speech. He believes that his further work on the Aleutian Islands will have much importance for primitive culture. In the seventh decade of the last century, Dr. Dall made excavations on these islands and Jochelson has been able to verify some of his observations, but he reports that Dall was mistaken in many of his conclusions. The explorer expected to spend last winter on Umnak Island and to carry his collections in April, this year, to Unalaska.

AGRICULTURE AND IRRIGATION IN BRAZIL. It is a sign of industrial health that Brazil has become interested in mixed farming and the possibilities of irrigation. Mixed farming is highly desirable in view of the depression caused by the drop in the coffee market on account of over-production. Attention is called in government reports to the possibilities in rice production, Brazil being one of the great rice consuming countries; and a fair start has been made in this industry on a scientific basis. Wheat production has also been encouraged to a notable extent and the industry is capable of great development. More recently, great activity has been displayed in the irrigation projects of the arid states of Ceara, Parahyba, and Rio Grande del Norte, the government sending a commission to the United States to study our irrigation projects and problems. The provinces in point (*Daily Consular and Trade Reports,* No. 3675, Jan. 3, 1910) have long been known for their severe drought. They lie along the coast

northwest of Cape San Roque where the direction of the prominent topographic features corresponds to the direction of the prevailing trades with the result that but little water is precipitated, in contrast to the abundantly watered coast southwest of Cape San Roque toward Rio Janeiro. A new law makes provision for the construction of dams and reservoirs, wells, river dikes, sea walls for the reclamation of low-lying and wet coastal lands, and highways and railways from the coast to the interior to furnish cheap transportation facilities and enable the sphere of cultivation to be extended much farther than at present. A scientific study is also being made of the geological, topographic, and meteorological conditions and effort is also being made to conserve forest resources and to begin reforestation. The national government assists the individual state only upon condition that at least 5 per cent. of the annual receipts of the state government are spent in ameliorating the conditions due to drought.

ISAIAH BOWMAN.

ASIA

KOSLOFF'S EXPEDITION IN CENTRAL ASIA. The first year's work of this Russian expedition resulted in some interesting finds. Entering northern Mongolia from Kiakhta, Kosloff found, near the ancient channel of the Etsin-gol, a river that rises in the Nan Shan range and flows into the Gobi Desert, the sand-covered ruins of a former city. Excavations yielded many documents, coins, household articles, etc., which were sent to St. Petersburg where experts found, on examination, that the city flourished between the 11th and 14th centuries. Later, Col. Kosloff spent three weeks on the southern shores of Koko Nor, the famous lake of northeastern Tibet, taking scientific observations and studying the hydrography of the region. Its coast line measures about 230 miles, and it is subject to sudden and violent storms. Two members of the scientific staff visited the island of Kuisu, the first Europeans who have reached it, though many pilgrims go to the island in winter, on the ice. Three monks were found there, each living in his own cave and with his own flock of sheep and goats. A temple stands there. The greatest depth of the lake, shown by the soundings, was 120 feet, near Kuisu. Col. Kosloff says the lake is slowly shrinking and the natives there report that the island of Kuisu has grown perceptibly larger in the past generation.

Detached parties explored a considerable area on both sides of Kosloff's route. A hitherto unknown corner of the Chinese province of Kansu was visited and the positions of 9 new towns were fixed. A full report of the first year of Kosloff's work appears in the *Geographical Journal* (Oct., 1909).

AUSTRALIA

THE CAPITAL OF THE AUSTRALIAN COMMONWEALTH. After some years of discussion, the location of the capital of the Australian Commonwealth has at length been selected. The site chosen for the capital town is at Canberra on the Molonglo tributary of the Murrumbidgee R., in New South Wales, about 300 miles to the southwest of Sydney. The federal district surrounding the capital is about 1,000 square miles in extent and includes the entire basins of the Cotter, Molonglo and Queanbeyan rivers. In fact, the leading consideration in the choice of land for the capital and federal district was the water supply, and it is believed that the catchment area selected will provide all the water required

for every purpose. The port of the capital will be built at the south end of Jervis Bay, about 100 miles east of the federal territory, and a route for a railroad between the port and the capital has been selected. The present population within the district is only about 4,000. The region is beautifully diversified by hill and valley and the general elevation is from 1,800 to 2,000 feet. The capital will be some 100 miles south of the railroad between Sydney and Melbourne and a branch road from the main line will pass through the federal district. Joint legislation by the Australian Parliament and the legislature of New South Wales were required for the transfer of the territory to the federal government.

POLAR

MR. LEFFINGWELL IN ALASKA. A letter to the Bulletin from Dr. C. W. Leffingwell, father of the explorer Ernest DeK. Leffingwell, reports that a communication from his son, written on Nov. 1, 1909, says that he had landed his stores safely on Flaxman Island, north coast of Alaska, and with the aid of two white men and some Eskimo had put up a small house, 16 by 24 feet, adjoining his old camp. This will furnish a comfortable shelter, being banked up with snow blocks, and will give protection to his instruments and papers. He will continue his geodetic and geological work on the north coast of Alaska for two or three years more, the expedition being at his own cost. His camp is not far from the Canada line, and possibly the overland surveyors of the line may be able to compare notes with him, next summer. He will make some very careful observations, with good instruments, to establish some point of longitude on the coast, more accurately than has heretofore been done.

THE NEW SCOTTISH ANTARCTIC EXPEDITION. Dr. W. S. Bruce was the leader of the *Scotia* Antarctic Expedition whose scientific results have taken high rank as important contributions to our knowledge of the Antarctic regions. On March 17 last, he addressed the Scottish Geographical Society on the new expedition which he hopes to lead to the Antarctic regions next year (*Scot. Geog. Mag.*, April, 1910). It is hoped that the expedition will leave Scotland about May 1, 1911, reaching Buenos Aires about June 20. It will sail thence for Cape Town, steering a zigzag course between 40° and 50° S. to supplement the bathymetrical survey of the South Atlantic begun by the *Scotia* in 1902-04. From Cape Town the party will steam direct to the Sandwich group, making soundings to try and prove the connection of the hypothetical "Rise" joining the Sandwich group and Bouvet Island, as well as the "Scotia Rise," discovered by the Scottish expedition in 1904.

The expedition will then steer from the Sandwich group for Coats Land with a view to erecting a house and landing 10 or 12 persons there. As there appeared to be no suitable landing place along the 150 miles of Coats Land discovered by the Scottish expedition in 1904, the expedition may have to go farther west or, possibly, as far east as Cape Ann, Enderby Land.

After landing the sledge party, the ship will proceed to Melbourne, steaming in as high a latitude as possible to take soundings and make deep sea research with a special view to determining former continental connections. The ship will winter at Melbourne.

In the spring, a sledge party, under Dr. Bruce, will attempt to cross the Antarctic Continent from Coats Land to Ross Sea, by way of the South Pole. At

the same time, the ship will sail southeast from Melbourne to Victoria Land (Ross Sea) and will send a party south over the ice barrier with supplies for Bruce's sledge expedition. It is likely that the two parties will meet near Beardmore Glacier, up which Shackleton pushed his way towards the South Pole, a little over a year ago.

The two parties will then rejoin the ship, proceed to Magellan Strait or the Falklands, and carry on oceanographical research in as high a latitude as the winter season will permit. In the spring, the expedition will enter Weddell Sea again to relieve the wintering party that will then have spent two years there. This party, in the absence of the ship and Bruce, will have exerted itself to survey the coastline of Antarctica both to the east and west of the station. The expedition will carry complete meteorological, magnetic, and other physical and biological outfit. The cost will be about $250,000.

SIR ERNEST SHACKLETON'S PLANS. According to the London *Times* (Weekly Edition, March 4, 1910) Sir Ernest Shackleton said, just before his departure for America, that if he should decide to start, at a later date, on another expedition to the South Polar regions, the work he would undertake would probably be the exploration of the region between Cape Adare and King Wilhelm II Land. This apparently means that he would undertake to establish the coastal limits of the Antarctic Continent to the west of Cape Adare as far as Gaussberg, the mountain near which the Drygalski (German) expedition wintered. The land back of the mountain was found steadily to rise towards the interior. The Germans advance good reasons for their belief that this land is a part of the continent and to this region they attached the name of their Emperor. The region between Cape Adare and Kaiser Wilhelm II Land is the area which has long been shown on Antarctic charts as Wilkes Land, so called in honor of Lieut. Charles Wilkes, the commander of the United States expedition which, in 1840, skirted what Wilkes believed to be the border of a very extensive land to which he gave the name of the Antarctic Continent.

TEMPERATURES, PRESSURES, AND THE HEIGHT OF THE ANTARCTIC CONTINENT. Comment on Dr. Wilh. Meinardus's paper "Die muthmassliche mittlere Höhe des antarktischen Kontinents" appeared in the *Bulletin* for February, 1910 (pp. 125-6). Professor R. DeC. Ward, of Harvard, sends us the following in which he presents the temperature results obtained both by Meinardus and Hann:

"Dr. Meinardus considers Antarctic temperatures and pressures and the probable height of the Antarctic continent as indicated by these pressures. The same writer had previously determined the mean annual, January and July temperatures between latitude 60° S. and the South Pole ('Die Lufthülle,' in A. Scobel's *Geogr. Handbuch,* 5th ed., 1909, p. 74). The results obtained by Meinardus and Hann, for the mean temperatures of the south polar area, beyond the Antarctic Circle, are as follows:

MEINARDUS.			HANN.			MEANS.		
Jan.	July	Year.	Jan.	July.	Year.	Jan.	July.	Year.
27.1°	−13.4°	1.9°	25.3°	−15.5°	3.7°	26.6°	−14.8°	3.2°

"As these mean temperatures were determined by interpolation upon the basis of few data, the close agreement is very satisfying. Dr. Meinardus's conclusions regarding the altitude of the Antarctic continent are as follows:

"1. On the basis of the seasonal interchange of air over the known portions

of the earth's surface we may assume that over the South Polar area (within the Antarctic Circle) the *actual* pressure in January is about 11 mms. higher than in July.

"2. The observations hitherto made in the higher southern latitudes give sure evidence that the sea-level pressure is higher in January than in July. The decrease in the meridianal temperature gradient, and the resulting decrease in the easterly winds at the margin of Antarctica in summer, make it probable that the pressure reduced to sea-level is lower in summer than in winter. This would be a situation similar to that which actually exists in the North Polar area.

"3. The pressure excess of 11 mms. can easily be explained if the South Polar area is elevated.

"4. A mean altitude of the South Polar area of about 1350+or—150 meters can bring about the above-mentioned pressure excess.

"5. If we assume that the land area within the Antarctic Circle embraces 14,000,000 sq. kms., the mean altitude may be fixed at about 2000+or—200 meters.

"6. The observations of altitudes around the margins of the Antarctic make it seem possible that the mean altitude of the continent is considerable.

"7. The thickness of the ice cover plays an important part in the mean altitude, as is the case in Greenland."

CARTOGRAPHY

THE MAP OF THE WORLD IN 1:1,000,000. In accordance with the action taken at the Ninth International Geographical Congress, in Geneva, the British Government sent out invitations to the various countries interested to send delegates to a meeting to be held in London, on Nov. 16 last, for the purpose of deciding upon the details essential to the preparation of a uniform map (*Bull.*, 1909, p. 765). The countries represented were Austria-Hungary, Great Britain, France, Germany, Italy, Russia, Spain and the United States. The delegates from the United States were Mr. Bailey Willis, geologist, of the U. S. Geological Survey and Mr. S. J. Kübel, chief engraver of the Survey.

The initial meridian of Greenwich was adopted. The metric system was adopted with the provision that the scale of heights and distances may also be expressed, in addition to the metric system, in terms of miles or of any other unit. Conventional symbols for representing water courses, roads, railroads, towns, cities, etc., were agreed upon, the result embodying nearly all the conventions used on the maps of the U. S. Geological Survey. The Latin alphabet alone may be used in writing names, but the spelling shall be that of the official maps of each country. The adopted spelling for China is that of the post and customs service.

The representation of topographic relief will consist, in the main, of generalized contours so drawn as not unduly to obscure other features of the map. Shading will be used to bring out features that cannot adequately be shown by contours. Color effects also will be used to show the distribution of altitudes and sea depths more vividly. Shades of blue will denote different depths of lakes and seas; three tints of green will indicate low lands from sea level to 300 meters; pale buff will then be used up to 500 meters, followed by browns growing darker up to 3,000 meters; then come violet tints fading into white at the highest elevations above 7,000 meters.

Since the ocean covers three-fourths of the earth, the atlas is not likely to comprise over 1,500 sheets, including the oceanic islands.

The sheets falling to the United States, south of Canada, including slices of the oceans, Canada and Mexico, will number 52. Mr. Bailey Willis, in an article on the International Map (*Nat. Geog. Mag.*, Vol. 21, pp. 125-32), says that the U. S. Geological Survey has now 9 of these sheets in preparation, covering parts of the eastern, central and western states. They are being drawn on a scale of 1:500,000=7.8 miles to an inch. They will be reproduced, by photo-lithography for publication on a scale of 10 miles to an inch and, as Congress provides the funds, will be published on the scale of the International Map—1:1,000,000. Mr. Willis says: "It is to be hoped that the task may be prosecuted with energy, and that the first edition of the one-millionth map of the United States, as a part of the standard map of the world, may be engraved and published within ten years."

EDUCATIONAL GEOGRAPHY

School Geography in the United States. The report of the Committee of the National Educational Association, made in July last, has been published in the *Journal of Geography* (Vol. VIII, pp. 1-9). The report criticised the high school course in physical geography because it places too much emphasis upon the detailed study and classification of land forms, and too little upon human response to those forms; the concrete study of human response to its environment does not receive sufficient attention; the course aims to fit the student for college rather than for the affairs of life.

Secondary school geography does not give the student a grasp on natural resources, industries and commerce; as at present constituted, it cannot give the student an adequate knowledge of regions and peoples.

The Committee then presents as the essentials of a course in geography for secondary schools, those parts of mathematical geography showing how human life is influenced by the relations between the earth and other members of the solar system; atmospheric phenomena; the ocean as a modifier of climate, as an agent in the destruction and construction of land forms, as a source of commodities, and as a commercial highway; the larger geographic forms, such as plains, mountains, rivers, lakes, glaciers, etc.; the larger resources of our country, such as soils, waterways, water powers, forests and mineral wealth; the geography of the most important countries and peoples; the shaping of history by geographic conditions; the relationships between geographic forms and geographic processes; and the responses which human life makes to its physical surroundings.

The Committee recommends that Geography be a required subject in all secondary schools to be pursued not less than one year. It should also be presented during the first year of the high school course. There should be at least five recitation periods per week and one-fourth of the total time should be devoted to laboratory and field work. Lawrence Martin.

Geography in Germany. A conception of the scope of the work in geography given at the German universities may be gained from a perusal of the titles of recent geographic theses prepared for the degree of Doctor of Philosophy. The following are in part taken from the "Jahresverzeichnis der an den deutschen Universitäten erschienenen Schriften" published by Behrend & Co., Berlin, where

further details as to exact title, author, etc., may be found. The theses may be grouped according to subject matter under the following headings:

Physiography. On the Sierra Nevada of Spain (Berlin, 1908); The Status of Armenia in the Highland of Western Asia (Berlin, 1906); The Development of the Conception of the Term "Coast" (Leipzig, 1904).

Oceanography. The California Current (Göttingen, 1909).

Meteorology and Climatology. The Hurricanes of the West Indies (Bonn, 1907); The Climate of Davos, Switzerland (Heidelberg, 1907); The Meteorologic Equator in the Pacific Ocean (Göttingen, 1906).

Cartography and Cartometry. The Mensuration of Geographic Surfaces before the Invention of the Planimeter (Göttingen, 1906); The Theory of Isocronal Lines and their Cartographic Representation (Königsberg, 1908); The Mean Altitude of Asia (Kiel, 1906); A New Calculation of the Surface of the Continental Slope (Göttingen, 1909).

Anthropogeography. The Influence of Summer Resorts on the Density of Population and the Means of Communication in the Northwestern Thüringen Wald (Jena, 1908); Town Sites of Eastern Germany (Kiel, 1907); The Upper Limit of Human Habitation in Switzerland based on the Distribution of the Chalets (Bern, Switzerland, 1906); Bodin's Theory of the Influence of Geographic Position on the Political Life of Nations (Bonn, 1904); The Density of Population in the Northwestern Lowland of India (Göttingen, 1909).

Commercial Geography. Commercial Geography of Saxony (Jena, 1908); The Importance of Beasts of Burden in Africa (Jena, 1908); On the Railroads of the French Colonies (Jena, 1908); The Commercial Utilization of the Topography and Position of Ireland (Rostock, 1908); The Development of the Lines of Communication in Australia (Leipzig. 1906); The Passes of the Western Carpathians (Leipzig, 1906); Paths and Trails geographically considered (Leipzig, 1906); Commercial Geography of South Africa (Jena, 1905); Canada and the Hudson Bay Co.

Discovery and Exploration. The Discovery and Explorations of the Australian Coast and the Islands of the Pacific Ocean by the French from 1783 to 1830 (Bonn, 1907); History of the Discovery and Exploration of Greenland up to 1800 (Erlangen, 1906); Exploration of the Mainland of Indo-China by the Jesuits at the beginning and close of the Seventeenth Century (Würzburg, 1905); The History of Discovery and the Cartography of Africa up to 1749 (Munich, 1905).

Regional Geography. The North Brazilian Coastal State Ceará (Bonn, 1908); The History, Nature and Importance of the Island of Sachalin (Bonn, 1907).

Development of Geography and its Methods, and Biography. Geographic Courses at the former University of Altdorf (1623–1809) (Erlangen, 1908); Julius Fröbel's Investigations of the Methods and System of Geography and of their Place in the Development of Geography as a Science (Halle, 1908); Karl Ernst von Brun as geographer (Munich, 1908); Malte-Brun, France's Foremost Geographer in the first quarter of the Nineteenth Century (Leipzig, 1908); James Rennell, the Creator of Modern Geography in England (Leipzig, 1904); The Teleologic Bent of Karl Ritter's Mind (Leipzig, 1905); Alfred the Great as Geographer (Munich, 1904).

W. JOERG,

SUMMER FIELD WORK IN PHYSIOGRAPHY. Professor W. M. Davis will lead a party of students this summer, in physiographic field work in Colorado. The work will be open to students (men only) who already have some knowledge of physiography. It will begin at Denver, on July 6, six days a week, for two or three weeks, and will be extended by individual field work to five or ten weeks by those who wish to count the course towards a Harvard degree. The object of the course is to study parts of several ranges of the Rocky Mountains in Colorado, with particular attention to the best methods of describing the forms observed. Those who wish to attend this course should address Prof. W. M. Davis, 17 Francis Ave., Cambridge, Mass., stating the work they have already done in physiography.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Dictionary of American-Indian Place and Proper Names in New England; with many Interpretations, etc. By R. A. Douglas-Lithgow. xxi and 400 pp., Portrait, and Bibliography. The Salem Press Co., Salem, Mass., 1909. $7.

The laudable purpose of Dr. Douglas-Lithgow was to give all the Indian place names in New England, that have not been lost beyond recovery, to assign them their proper locations and, as far as possible, to translate them into English. The names are alphabetically arranged under each of the States; also, to present a list of American Indian proper names occurring in the history of New England with references to the literature in which the names occur and such facts as may be briefly given about the persons who bore them. The book concludes with lists of the principal Indian tribes of New England, specimen vocabularies, etc. A great deal of information, such as this book contains, has been irretrievably lost, and the great labor that Dr. Douglas-Lithgow has given to ensure the preservation of what remains, deserves the fullest appreciation.

De Reis van Jan Cornelisz May naar de Ijszee en de Amerikaansche Kust. 1611-1612. Verzameling van Bescheiden uitgegeven door Mr. S. Muller Fz. lvi and 226 pp., 2 Maps, Bibliography, and 2 Indexes. Martinus Nijhoff, The Hague, 1909.

Not much is seen in books of this navigator of the early part of the Seventeenth Century. He was skipper of the vessel De Vos which, with the De Craen, made a voyage across the Atlantic in 1611. In the following year the De Vos repeated the journey from west to east and it was one of the remarkable voyages of the early days. Starting from Cape Cod, she made for the north of Norway, then sailed to Novaya Zemlya and pushed boldly north through Barents Sea till she was stopped by ice above the 77th parallel. Thus May had a good opportunity to observe conditions in the European ice ocean and also along the American coast from Newfoundland to Nova Scotia and southward to Cape Cod. He recorded his observations and impressions in a voluminous journal from which Mr. Muller has derived most of this book though he has also drawn upon other sources of information. The work is a valuable addition to the literature of the early navigators.

Henry Hudson in Holland. An Inquiry into the Origin and Objects of the Voyage which led to the Discovery of the Hudson River. With Bibliographical Notes. By Hen. C. Murphy. Reprinted with Notes, etc., by Wouter Nijhoff. xii and 150 pp. Martinus Nijhoff, The Hague, 1909.

A reprint of the book published in 1859 by Henry Cruse Murphy, who was then our Minister at The Hague. Mr. Murphy made an investigation to ascertain,

more precisely than had been explained up to that time, what originated the voyage that Hudson made in behalf of the Dutch East India Co. and which resulted in his exploration of the larger part of the Atlantic coast of the United States and his discovery of New York Bay and its noble tributary. Mr. Murphy prepared a clear account of the initiation and details of the expedition and published important documents that were then first brought to light. The edition he printed was small and the work is now very scarce.

In the reprint, Mr. Nijhoff gives the documents both in the original and in English while Mr. Murphy printed only a translation. Other documents are also inserted and the editor has supplied many notes and an adequate bibliography. The work well deserved reprinting and the additions made to it enhance its value.

De Zuidwest Nieuw-Guinea-Expeditie 1904/5 van het Kon. Ned. Aardrijkskundig Genootschap. xxvi and 676 pp., 9 Maps, Illustrations, Plates, and Diagrams. E. J. Brill, Leyden, 1908.

A detailed account of the adventures and discoveries of this expedition which was sent out by the Royal Dutch Geographical Society to explore the south-west coast of Dutch New Guinea and, if possible, to reach the lofty range of mountains extending eastward from the peninsula south of Geelvink Bay. Two steamers, the *Flamingo* and *Anna,* were loaned to the expedition and the colonial government gave all assistance in its power. Mr. R. Posthumus Meyjes, the leader of the expedition, made a preliminary cruise along the coast to be explored and in September, 1904, the party set out from Surabaya, Java, on their two vessels. On reaching the south-west coast, the effort was first made to find good anchorage ground near the mouth of some river that might afford a navigable way for small boats and thus facilitate a journey towards or to the great Sneeuwgebergte (Snow Mts.) first seen by Carstens in 1623. Attention was first given to Flamingo or East Bay and the North river which empties into it which was later ascended to within sight of the highest peak of the Snow Mountains whose height was fixed at 16,700 feet. Its position was determined as 4° 3′ 30″ S., 137° 8′ E., and its top is snow-crowned.

The first penetration of the interior, however, was made from Etna Bay, south of the Geelvink Peninsula and a party under Captain de Rochemont advanced towards the Charles Louis Mountains, the western end of the great interior range. Owing to difficulties with the coolies this expedition was not entirely successful though the unknown Omba river and its tributary, the Aru, were ascended for 30 miles and an elevation of 6,600 feet was attained at the last camp.

The work included the rectification of the mapping of the entire southern coast line. The astronomical observations were connected with those of Australia through Thursday Island. Pisang Bay was found to be a delusion and was wiped off the map. The Digóel river, discovered in 1903, was ascended for 300 miles from the sea. The work in the interior was in entirely new country. Nearly the whole of this large volume is a pioneer contribution to our knowledge of the lands, hydrography and peoples of the southern part of Dutch New Guinea. The book is profusely illustrated with photo-engravings and maps, many of the illustrations showing the inhabitants and their rude arts. The whole work reflects credit not only upon the explorers, but also upon the Royal Dutch Geographical Society.

Mannus. Zeitschrift für Vorgeschichte. Organ der Deutschen Gesellschaft für Vorgeschichte. Herausgegeben von Professor Dr. Gustaf Kossina. Vol. 1, Nos. 1/2 and 3/4, pp. 327. Curt Kabitzsch (A. Stuber's Verlag), Würzburg, 1909. 16 Marks a year.

In January last year, the Deutsche Gesellschaft für Vorgeschichte was organized, in Berlin, with 200 members and under the presidency of Prof. Dr. Gustaf Kossina, of the University of Berlin. Before the end of the year, the Society issued the first numbers of *Mannus* which will contain its literary contributions to prehistoric research. This new journal bids fair to place Germany on even terms with France, Belgium, England and Switzerland in its literary output relating to prehistoric times. In the excellence of its contents and its superior mechanical production, *Mannus* compares favorably with the foremost publications on this subject. The number of parts issued each year will not be definitely fixed, but will be at least three or four. Dr. Kossina, the editor, in the first (double) number, begins a series of articles on "Der Ursprung der Urfinnen und der Urindogermanen und ihre Ausbreitung nach dem Osten." Among the other titles of extended papers are "Das Sonnenrad und das christliche Kreuz," "Urzeitliche Astronomie in Westeuropa," "Übersicht über die Forschungsergebnisse in Nordböhmen," etc. The papers are beautifully and copiously illustrated with photo-engravings, wood cuts, diagrams and maps, some of them in colors. The departments include communications and discussions, reports from societies and museums in Germany and other countries, and book reviews. Single numbers will not be sold, but *Mannus* may be obtained by annual subscription.

Handbuch der Klimatologie. Von Dr. Julius Hann, II Band., Klimatographie. I Teil: Klima der Tropenzone. 3te, wesentlich umgearbeitete und vermehrte Auflage. Pp. 426. Stuttgart, Engelhorn, 1910. 14 marks.

Teachers of climatology the world over, meteorologists, medical men—in fact, all men of science who at one time or another need climatological data, will welcome the appearance of the second volume of the third edition of Hann's splendid "Handbuch der Klimatologie." The first volume, dealing with the general aspects of the subject, was recently noticed in the *Bulletin* (Vol. XLI, No. 3, March, 1909, pp. 181-183). The volume now before us deals with the climates of the tropical zone. The author has very wisely maintained the familiar classification of the zones by latitude circles for the purposes of this discussion, instead of attempting to divide his data in accordance with any newer scheme. By adhering to the most widely-known and most practical classification he has made his volume of far more general service. He recognizes, of course, the value and the greater scientific accuracy, from the standpoint of climatology, of the division by isotherms. The amount of labor necessary in the preparation of this book is so stupendous that one can only marvel at it,—and be devoutly thankful that Hann has had the health and strength to accomplish it. For he has laid the whole scientific world under a debt of gratitude to himself. The tediousness of reducing the temperatures of station after station to true means can only be appreciated by those who have carried out such a task, and yet the author modestly says, of this stupendous labor, "die erforderliche Arbeitsleistung war keine geringe . . . . Die Temperaturmittel sind nach Möglichkeit auf wahre Mittel reduziert worden . . . . Die Jahresmittel . . . halte ich für recht sicher."

Those who have kept up with Hann's recent work will remember that he has lately paid special attention to the whole question of the determination of true means from the temperature observations available for tropical stations. It is for the reason that one is so serenely sure of all of Hann's work that the "Handbuch der Klimatologie" is so indispensable.

Every one knows that this book is the source of information on the climates of the globe. Dry tabulation of uninteresting data is not the distinguishing characteristic of this volume; far from it. Tables of such data there are, in goodly number, and surely there must be; but so carefully selected are these data, so admirably summarized, and so skilfully interspersed with well-chosen, thoroughly live descriptions of the different climates, that the study of the book, and even the reading of it, is neither tedious nor difficult. The author clearly recognizes the importance of descriptions of the weather types which make up climate, and of the controls of climate over crops, and over human life in all of its varied activities, and he has certainly made a careful and an admirable selection of such descriptive accounts.

The second volume of the second edition numbered 384 pages; the second volume of the third edition covers 426 pages. We note also that the present volume has its own index. In the second edition, the index to all three volumes was at the end of the third volume, which was a considerable inconvenience. The introductory chapter, on the characteristics of the tropical zone as a whole, has been extended, and improved. In fact, throughout the volume, there is everywhere evidence of careful, systematic and up-to-date revision, the literature up to the middle of 1909 receiving consideration. The increased size of the page in the new edition lends itself more readily to a clear presentation of the tabular matter than was the case in the second edition. Numerous bibliographic notes enable those who seek fuller information to follow up the subject at every turn. In fact, the whole volume is one which it is an immense satisfaction to the reviewer to bring to the attention of his scientific colleagues. It is a book which belongs to that very small class which may be labelled "perfect."

R. DeC. Ward.

La Côte d'Azur Russe. (Riviera du Caucase). Voyage en Russie méridionale, au Caucase occidentale et en Transcaucasie. Par E.-A. Martel. 354 pp., 388 Illustrations, 34 Plans and Map. Librairie Ch. Delagrave, Paris, 1908. Fr. 10.

In 1902, Mr. Martel was invited by the Russian Government to undertake a journey of exploration in the western Caucasus with the end in view of thorough development of this Russian littoral of the Black Sea. The genial climate of the western slope of Caucasus, well protected from the cold winds, combined with wonderful scenic beauty, led to the establishment of a tourist and health resort in this Caucasian Riviera between Novorossyisk and Soukhoum-Kalé. This coast is admirably adapted for sea bathing; and magnificent forests in the background afford ideal spots for sanatoriums. The Russian Government is very desirous to bring this Riviera up to date in all respects. New towns are being established, and the work of colonization is pushed on rapidly.

This volume, the result of Mr. Martel's explorations, gives a detailed account of conditions at the present time.

Natural conditions for a brilliant future are there and in plenty, but may not

be fully realized, according to the writer, until two essential difficulties in the way of development are obviated. These are poor communications and the existence of endemic fever. A railroad line must be built from Novorossyisk to Poti, the present mode of communication by steamer between these two ports, a distance of 450 kilometers, being entirely inadequate.

As regards malaria, Mr. Martel found that, the climatic, topographical ond hydrographic differences between the Pontian malarian districts in western Europe and the Caucasian littoral are entirely in favor of the latter. The fever here has less tenacity and wherever hygienic measures have been introduced and a drainage system established, has entirely disappeared.

The necessity of hydrological investigations was particularly emphasized, and much attention has therefore been given by Mr. Martel to the question of water supply, the exploration of subterranean streams, caverns, and grottoes. As a speleologist, the author would have liked to spend more time than he did in cave exploration. Nevertheless such explorations of caverns as he was able to make, helped to confirm the conclusions he had reached in earlier speleological researches in other countries and to prove the law of absorption of rain by abysses, the storing of waters by caverns, the reappearance of the same waters again, the burying of subterranean canals, the desiccation of caverns and the general descent of subterranean waters into the depths of the earth's crust. The accidental relation of grottoes to metalliferous veins has been proved to be more frequent than their direct relation to the thermo-mineral springs which offer few examples up to the present time. However, the renowned mineral springs of Matsesta, have a direct relation to two neighboring caverns. Many caverns are hard to explore on account of a great abundance of sulphurous gases. At the apertures of the caverns, where thermal springs are found, a great number of votive offerings may be seen. Thus, the universal cult of the therapeutic waters is found here as everywhere else.

Geologically the soil is prodigiously varied. The similarity of the subterranean hydrology to that of the Karst, Causse, etc., is obvious and confirms the synthesis established by the author of the régime of subterranean waters in fissured calcareous soil.

A chapter is given to the climate of the littoral. The mean temperature in western Caucasus is 14.2° C. and the first flowers appear in January. The large precipitation is due, in part, to the peculiar shape of the Black Sea where the north and west winds, laden with moisture, buttress the high mountains of Caucasus and Lazistan. The author asserts, what is now usually denied, that the immense forests greatly influence rainfall. Though the humidity is excessive, Mr. Martel is far from advising the cutting of forests. He firmly believes in their beneficial influence on climate. But he strongly advocates clearing away the underbrush in order to eliminate the excess of moisture.

Western Caucasus has the distinction of being the only country, except Bielovieza in Lithuania, where the European bison still lives. There are about 600 head on the preserves of one of the Grand Dukes and it is also found in the mountain forests.

Much remains to be studied and revealed on this Black Sea littoral. Good roads, drainage, the regulation of drinking water and many other improvements are needed, but, when this is accomplished, the Russian Riviera may well rival, as a tourist resort, the French and Italian Rivieras, particularly as the scenic

beauty of the Caucasian littoral surpasses that of the Mediterranean pleasure resorts. The inhabitants of this region are inclined to be indolent and lack initiative. On the other hand, they have extraordinary endurance. Tea plantations flourish and a considerable amount of wine is produced. The table mineral waters are highly effervescent. The well known Narzan and other brands are much appreciated throughout the Russian Empire and are now an important item of export. Mr. Martel was surprised to find that in a large hôtel-pension at Sotchi, one of the fashionable stations, only mineral water, tea and coffee could be obtained. He compares these Russian hotels to the temperance houses in Ireland.

Geographically, the value of this book is increased by the fact that the author carefully read and studied all the books and articles written on this region, enumerates and cites them frequently, pointing out diversity of opinion, errors in estimated altitudes, etc. The descriptive part of the volume is very entertaining, written in a vivacious and easy style, with touches of humor truly Gallic.

H. DE HUTOROWICZ.

Sicily, the Garden of the Mediterranean. The History, People, Institutions, and Geography of the Island. By Will S. Monroe. xx and 405 pp., numerous Illustrations, and Index. L. C. Page & Co., Boston, 1909. $3.

A good book written with a sincere purpose to make it useful to the tourist and interesting and instructive to the general reader. The human side of the subject is emphasized and the larger part of the book is given to the manners, customs, habits and institutions of the Sicilians. The topics, in order of treatment are the geography of Sicily, its history, the ethnic, moral and social conditions of the people, hostelries, brigandage, the Mafia, religion, education, industries, commerce and the creative arts. The final chapters are on Mount Etna, the leading cities and their chief monuments, the Messina earthquake, suggestions for tourists and a select bibliography.

Through Uganda to Mount Elgon. By J. B. Purvis. 371 pp., 42 Illustrations, Map and Index. American Tract Society, New York, 1909. $1.50.

This excellent book was written by a missionary who has long lived and labored in British Central Africa. He records here the results of years of observation and experience and his book, though an entertaining narrative, is not superficial. A third of it is given to his latest journey, this time by rail, from the Indian Ocean to Victoria Nyanza, the present condition of the tribes along the way, the effect upon them of the white domination, and the dread scourge of sleeping sickness.

Another third is devoted to Uganda in its past and present aspects; and the author vividly depicts the rapid strides that have been made in bridging the gulf between primitive barbarism and western civilization. He deplores, however, the present stagnation in the religious life of the people who are thirsting, instead, for general education and material good. The government is doing nothing towards the industrial education of the natives and such progress as has been made in this direction is due to missionary effort. Progress is now embarrassed by shortness of the labor supply and the regular increase of wages.

The last third relates to the almost unknown region east of the Nile to Mount

Elgon among the Bagishu, a cannibal tribe. This section is, in the main, a new contribution to our knowledge of Africa. The book will have a worthy place in the literature of the east central part of the continent.

Sunset Play Grounds. Fishing Days and Others in California and Canada. By F. G. Aflalo. xii and 251 pp., many Photo-Engravings, and Index. Witherby & Co., London, 1909. 7s 6d.

The author is a British authority on sport, a devotee of fishing, a lover of scenery, and an insatiable vacation traveller. His books are many; and the present volume will be especially helpful to anglers for he is a master of the fishing art, has had large experience in strange and distant waters, discusses local conditions, and sums up the expense. He went to California, by a circuitous route, especially to catch tuna at Catalina Island off the coast. This enormous game did not materialize, but Catalina is a paradise for sea fishing and the author had fine sport with sea bass, yellowtail, and albacore. He also tried his skill in Lake Tahoe and a number of Canadian lakes. Much of his book is given to the places he visited from Barbados and Panama to the Yosemite Valley, the Canadian Rockies and prairies, Niagara and the St. Lawrence. He bubbles over with humor and there are one or two smiles to every page. In Seattle, he says, the Carnegie library contains 100,000 volumes, "including works by myself, Shakespeare, and Mr. Bernard Shaw." In his many comments on our country and people, he stretches the truth a little for purposes of fun or sarcasm; but what he says about fishing may be absolutely relied upon.

Die Entwicklung der Kontinente und ihrer Lebewelt. Ein Beitrag zur vergleichenden Erdeschichte. Von Dr. Theodor Arldt, Oberlehrer an der Realschule in Radeberg. Mit 17 Figuren und 23 Karten. Leipzig, Wilhelm Engelmann, 1907.

Palæogeography is a very young science, and can hardly be said to date back farther, in fact, than Neumayr's treatise, of 1885, on the Jurassic formations. So far it has received rather one-sided treatment because it was based exclusively on marine life regardless of the testimony of the lands. It is this vacancy which the author wants to fill by his comparative history of the earth, and more especially of the continents. As the book is a first attempt in this line, some space is devoted also to an explanation of the methods of palæogeography, with an examination of their specific values. Each one, if used exclusively, can lead to but imperfect results. Comparisons of the geological formations are naturally limited to what erosion has left over for us, but cannot ascertain their original extent; that of palæontology is insufficient through the incompleteness of the fossil remains; plant and animal geography only allow us to guess the approximate distribution of land and water in former ages, but never to define old coast lines or even the outlines of continental shelves. It is only by a combination of the four sources of records that anything like accuracy can be obtained, and therefore the author refuses to accept as a fact any deduction that is not based on at least several, if not all, of the classes of testimony named.

After this explanation of his method, the author offers in the two main parts of the book, first, a geological history of the organisms by realms and classes, and of the old continents and oceans, followed by discussions of the laws and processes which determined their evolution; secondly, a geological history of

the earth by periods, with a comparative review of the continents, plants, and animals, of each. An adequate review of the book would require the combined efforts of a geologist, biologist, palæontologist, physicist, astronomer, chemist, and others. The geographer-geologist ought to be recommended especially to the study of the "cycles" in earth history which the author wishes to establish. He finds that there is a regular repetition, in the history of the land, of marine transgression, mountain upheaval, vulcanism, and glaciation, *viz:* (1) A cenozoic-mesozoic cycle: Diluvial ice age—eruptions of basalts, trachytes, phonolites—formation of the Alpine system—mesozoic transgression. (2) Young-palæozoic cycle: Permian ice age—eruptions of porphyries, etc.—formation of the Hercynian system—Devonian transgression. (3) Middle palæozoic cycle: Devonian ice age—eruption of diabases—formation of the Caledonian system—upper Silurian transgression. (4) Old Palæozoic cycle: Silurian ice age—eruption of diabases—formation of the Brazilian system—Cambrian transgression. (5) Algonkian cycle: Precambrian ice age—eruption of diabases—formation of Hebrides system—lower Algonkian transgression, etc.

These cycles seem to be proven from the Middle Devonian up, and probably for the earlier periods. Thus, the author asserts, our present knowledge of earth history is perfectly sufficient to establish rational and continuous processes of development in obedience to general laws. In spite of great changes in the arrangement of the continents on the globe there are nowhere indications of great catastrophes, only of continuous progress, not always in a straight line, indeed, but always with a positive net result in the end. One may well say, in the author's own words, that, no matter whether his theories are right or wrong, they are at least possible, and it will certainly require not a little work to improve on them.

A bibliography of 304 numbers, complete indices of authors, animals and plants, places and subjects, and 23 maps, make the book a treasury of palæogeographic references even for those who are not particularly interested in the subject as a whole. One familiar with the problems of the profession cannot help wondering how a comparatively young German high school teacher ever found the time to write it. MARTHA KRUG GENTHE.

Ein unerschlossenes Kulturland. Neuquen und Rio Negro, Argentina. Von W. Vallentin. vi and 229 pp., and 74 Illustrations. Hermann Paetel, Berlin, 1907. M. 3.

Vallentin's book is political rather than geographical. He desires to promote the formation of German colonies among the eastern, Argentine valleys of the Andes, between the 36th and 42nd parallels, that German ideals, language and customs may be preserved out of the Fatherland as well as in it, and that another market may be made for German wares.

Dr. Vallentin rode through the southern half of the region referred to, a few years since, and devotes two-thirds of his book to a charming, readable account of this journey. His style is easy and very vivid, calling before the reader's mind the dreary eastern pampas that must be traversed before the foothills are reached, where "splendid dark foliage rises from the carpet of lighter colored grass. Out of the blue-black ravines peeps the moist green of shrub and bush, and between grey, moss-grown ledges flash the clear waters of the mountain torrent. Everywhere, in clefts and hollows, on slopes and in valleys a luxuriant

plant-world; grass, bush and tree, and far away the sober mountain giants with bluish shimmering ice-caps on their white heads, the soft snow mantle around their shoulders: truly an imposing view."

The personal element, descriptions of the rare inhabitants, the means of travel, the plants and animals are the strong features of the book. Its contribution is not new subject matter to geography. Moreno drew the picture twenty-five years ago, but this appeal to another audience is an attractive one.

The author's patriotism is intense. He sees a bit of heaven in every German farm. Not that he is blind. He bemoans his countrymen's lack of co-operation, but German faith, German industry, German cleanliness, German hospitality are words he loves to conjure with. That his aspiration for a solid German-speaking population in a foreign land should arouse fears of a "German Peril" seems to him puerile and due to the machinations of "our dear cousins across the Channel" and the North Americans. "No one in Germany has any thought of such folly. Such settlements are of course for private enterprise, the Government has nothing to do with them, at least it must never put itself to the front."

Chile still supplies the scanty population of the agricultural strip and dominates its commerce, thus repeating the history of the western provinces further north, all of them first settled from across the Andes and still closely bound to the Pacific coast by the exportation of Argentine cattle. The railroad that was just touching the eastern border of Neuquen was beginning to promise a closer intimacy with the national capital, but the rail-head was still 250 miles from Lake Nahuel Huapi, the central point in the fertile belt which is in good communication with Chile by the Perez Rosales pass. This is little more than 3,000 feet above the sea and small steamers ply on the lakes at both sides.

As yet agriculture is limited to supplying the very limited local consumption, the population is less than one to a square mile, and grazing is the only profitable business; but with the coming of the railroad this will change, for the possibilities are great. The best lands have been taken up already by Chilean, English and North American speculators and prices are rising (as high as $4 an acre, for purely grazing lands), but a company with capital could still obtain ground at reasonable rates. The author—a captain with the Boers—fears that the English will seize all the chances and build a railroad, too.

Voss's map gives this belt less than twenty inches rain, though the higher slopes doubtless receive more and irrigation should be nowhere difficult. Within the mountain border nearly every valley has agricultural lands. The east is almost a hopeless desert which includes most of Rio Negro and perhaps half of Neuquen. There remains an area rather smaller than Switzerland, with a warmer climate but much less rain.

The illustrations are not very good and a number of them are much retouched.

MARK JEFFERSON.

Corrasion by Gravity Streams with Applications of the Ice Flood Hypothesis. By E. C. Andrews. Department of Mines, Sydney, N. S. Wales. Reprinted from *Journal and Proc.* of the Royal Soc. of N. S. Wales, Vol. 43, 1909, pp. 204-330, 11 figs., 3 appendices, and a bibliography.

An important paper with new conclusions relating to certain valley forms due to glaciation. The first part is devoted to theoretic considerations of stream bow and channel scour, the second to applications of principles to ice streams

and their associated valley forms, and the third to the application of hypotheses of origin to specific areas. The most important point in the paper relates to a modification of Johnson's hypothesis for the bergschrund origin of cirques. Without invalidating Johnson's conclusions with respect to basal sapping of the cirque wall, the author yet considers that the different erosive values of present and past glaciers have not been taken sufficiently into account. He regards the present bergschrund as an effect rather than a cause of modern cirques (p. 286); and as the result of tension in a crystalline solid which, during the glacial period, was continuous owing to greater velocity. It is also concluded that under the conditions during vigorous ice-cutting it is improbable, on theoretic grounds, that the bergschrund could have penetrated to bed-rock at the foot of the cirque wall. He finds that the smaller and newer cirques of waning ice streams are steeper than the older enveloping forms, and have far more favorable opportunities for basal sapping due to temperature fluctuations above and below the freezing point as controlled by the bergschrund.

The analysis merits consideration by American physiographers for it calls attention to the necessity for considering the glaciers once occupying certain mountain valleys as waxing and waning glaciers which produced quite different erosional effects during different periods of their cycle of development. The application of the principles of stream flow to the valley forms of glaciated regions is exceptionally effective and would seem to throw new light not only upon cirques and channel steps but also upon hanging valleys. The best development of hanging valleys is found to be in those regions where the landscape was prepared by pre-glacial erosion for great local variations in glacier velocity and hence in valley deepening. ISAIAH BOWMAN.

Fighting the Slave-Hunters in Central Africa. A Record of Twenty Six Years of Travel and Adventure Round the Great Lakes and of the Overthrow of Tippu-Tib, Rumaliza and Other Great Slave Traders. By Alfred J. Swann. Introduction by Sir H. H. Johnston. xvi and 359 pp., 45 photo-engravings, Map, and Index. J. B. Lippincott Company, Philadelphia, 1910. $3.50.

All who know the work that Mr. Swann did in British East Africa and the Nyasa Protectorate during more than a quarter of a century (1882-1909) will be glad that he has written this book. He began his busy life there before the activities of the whites had made any change in the aspect of country and peoples. During a large part of his African career he was high in the service of the British Government. No man knows that part of Africa better than Mr. Swann; and his book contains the gist of what he learned and of his many adventures during long years of labor and anxiety. He had much to do with the Arab and native slave traders and for twenty-six years he was prominent in the efforts to crush their accursed traffic; and he tells the story of a large part of eastern tropical Africa from the days when caravans brought thousands of slaves to the east coast and left thousands dead upon the road, to these modern times when great numbers of natives are learning trades and hundreds of thousands have seen mighty changes in their condition and outlook.

This book, written out of uncommon fullness of experience, is one of the most informing works on any part of Africa that has appeared in a long time. A good feature is the detailed description written under each of the illustrations.

In the Grip of the Nyika. Further Adventures in British East Africa. By Lieut.-Col. J. H. Patterson. xiv and 389 pp., engravings from half tones, Maps, and Appendix. The Macmillan Company, New York, 1909. $2.00.

This book, by the author of "The Man-Eaters of Tsavo," can scarcely fail to have as many readers as the earlier work. In the opening chapter he records a few hitherto unreported appearances of man-eating lions, but nearly all the book is given to the unadorned recital of his adventures, many of which were really exciting, among the wild men and wild beasts of the part of British East Africa where he has made his recent expeditions.

His latest journey was for the purpose of delimiting for the government of British East Africa a part of the boundary of the great northern game reserve which extends from about fifty miles north of the equator to within the same distance of Abyssinia. On this expedition he penetrated into little known regions and his sketch maps of the Guaso Nyiro are good material for the improvement of our mapping of this part of Africa. The incidents of this journey are of unique interest and the author's description of the country and its human and animal life will well repay any reader. There is probably nothing finer in recent writings on Africa than the pages which Col. Patterson gives to the night he spent in hiding at a solitary water hole and his record of what he saw when he was alone with many varieties of animals from giraffes to lions (pp. 259-263).

Marcus Whitman, Pathfinder and Patriot. By the Rev. Myron Eells, D.D. 349 pp., Illustrations, and Index. The Alice Harriman Company, Seattle, 1909.

Perhaps the time has come when the work and experiences of our pioneers and pathfinders will be more highly treasured than ever. This book is of such a character. No one was better qualified to write the book than the late Rev. Dr. Eells. Fortunately, he completed his manuscript before his death and a number of citizens of our northwest coast have rendered the patriotic service of supplying the funds needed to publish it.

The story of Marcus Whitman, missionary, is really a history of a part of the early days on our northwestern coast. Many have given to Whitman the credit of being the primal influence in keeping Washington and Oregon for the United States at a time when this vast domain seemed destined to fall into the hands of England. However this may be, Dr. Whitman was one of the strongest personalities in the northwest; and this book tells just what he and his young wife found when they cast their lot in that great wilderness, and how the unfolding of events there was a part of their own life story, till the tragic day in 1847, when both were massacred, with many other whites, by the Indians. This book will have its own place in the history of that part of our country.

Manual of Physical Geography. By Frederick Valentine Emerson, Ph.D. xvii and 291 pp., 58 Figs. and Index. The Macmillan Company, New York, 1909. $1.40.

Dr. Emerson's book includes two hundred and one exercises tested by the author in classroom practice. Of this total one hundred and seventeen are starred as particularly good. Eight exercises are devoted to The Earth as a

Planet; eight to Temperature; eight to Moisture; ten to Cyclones and Anti-cyclones; twelve to Miscellaneous Climatic Phenomena; three to Common Minerals and Rocks; one to The Contour Map; thirty-one to Weathering, Streams and Stream Valleys; thirty-three to Land Forms, due to structure; fifteen to Glaciation; twelve to Lakes; eleven to The Ocean; eleven to Shore Lines and Forms; twelve to Harbors; nine to Soils; and seventeen to Typical Areas.

As this outline of the contents indicates, the volume follows largely the plan of procedure in teaching physical geography in our high schools and colleges for the last fifteen years, but from which many of our colleges and normal schools and some of our high schools are breaking away. The exercises call largely for a formal and mechanical study of maps, deadening to pupils except where the teacher is a master.

Considering the emphasis that has been given increasingly to the human side of physical geography in the last five years, it is more than disappointing to find so little attention given in the outlines, to the human and life responses found in various physical areas. This disappointment is increased when one realizes that the author, by his other writings and in practice, has shown that the life side is most interesting and vital to him. Yet rarely is a suggestion of the life conditions mentioned under the land forms, and this phase is more emphasized under the topics dealing with the ocean than those dealing with the land areas.

We have had many manuals of physical geography, of which this is the most inclusive but not the most severe that has thus far appeared. The country is waiting with more than eagerness for a guide that will show how to develop strong laboratory work in reference to the broad geographic study of areas and types of land forms. Such a volume will blaze a new path in a thicket which many are trying to enter; the volume under consideration is the latest guide for a broad road that has developed from a trail in the last fifteen years. It is a suggestive book for those who would teach de-humanized physical geography (as the author could not do), but such work is rapidly yielding to humanized physical geography, even for those who are training to be specialists in the field.

R. E. Dodge.

Geographical Essays. By William Morris Davis. Edited by Douglas Wilson Johnson. vi and 777 pp., 130 Figures and Index. Ginn & Company, Boston, 1909. $2.75.

The republication in a convenient and welcome form of the chief essays on geography and geography teaching from Professor William Morris Davis, renders available for workers in the field many important papers that have hitherto been relatively inaccessible. Whether the interested worker is a specialist in the study of the genetic development of land forms or a worker in attempting to make the results of experts available in education, he must constantly refer to the work of Professor Davis and this volume will therefore be a treasury of valuable geographical materials to him.

The volume contains twenty-six essays of which twelve are entitled Educational Essays, and the remainder Physiographic Essays. The Educational Essays are largely devoted to the exploitation of the availability of physical geography for school and college work, and the arguments they include have been a large force in securing the place that physical geography has grown into in our higher

schools in the last fifteen years. It is significant that the latest article on physical geography included in the volume originally appeared in 1902 and that the article given first prominence in the volume, and dated 1906, gives less emphasis to physical geography and more to the wider outlook on geography from an educational standpoint that is constantly becoming more prominent in theory and practice.

The larger portion of the volume is devoted to the physiographic essays, several of which in their original appearance were epoch making and now classic standards. In order of appearance, and this order is roughly a history of the development of the physiography of the lands as a science, we have The Rivers and Valleys of Pennsylvania (1889); The Rivers of Northern New Jersey, with notes on the Classification of Rivers in General (1890); Plains of Marine and Sub-Aërial Denudation (1896); The Seine, The Meuse, and The Moselle (1896); The Geographical Cycle (1899); and The Peneplain (1899), followed by several others up to 1906. Those listed above, however, represent the several steps in the development of the modern accepted theory of land development and are basal in any study of the subject.

The volume is attractively printed, conveniently indexed and presented in a form worthy of the cause and the author. R. E. Dodge.

Geschichte der Erde und des Lebens. Von Johannes Walter, o. ö., Professor der Geologie und Palaeontologie an der Universität Halle. iv and 570 pp., and 355 Illustrations. Veit & Co., Leipzig, 1908. M. 14.

Persons who suspect geology of being a dry study ought to read this book. While the lay reader will find it fascinating, the scientist is compelled to admire the wonderful simplicity, clearness and unity of this presentation of our present knowledge of the beginnings and history of the globe, based upon the combined results of the earth sciences in the widest meaning of the term. A book like this is not a handbook proper nor a mere reference work however rich in references it actually is; it is a recreation of the matter itself through the scientific and artistic genius of its author.

In some aspects it reminds one of Suess's "Face of the Earth," without being so romantic; it restricts itself to what we, nowadays, accept as facts but arranges them in any way which leads thought beyond them. Little can be said about such a book in the way of introduction or criticism.

Its thirty chapters deal with (1) the properties of the earth; (2) geological forces; (3) the place of the earth in the solar system; (4) the formation of the moon and meteorites; (5) the formation, and subsequent changes, of the earth's crust; (6) the world ocean; (7) organic life; (8) atmosphere and climate; (9) the eruptive processes of the deep; (10) volcanism; (11) the development of earth history; (12) geological chronology; (13) the lower limit of the occurrence of fossils; (14) the traces of an Algonkian period; (15) the Cambrian; (16) halcyon days of animal development in the Silurian; (17) the old red North-land; (18) the Devonian Ocean; (19) the "Productus" seas; (20) the folding of the earth's crust and the formation of coal; (21) Godwanaland; (22) the Triassic seas; (23) the struggle of the northern desert with the Triassic seas; (24) the Jurassic seas; (25) the development of reptiles in North America; (26) the Cretaceous period and the great sway of death; (27) the Tertiary period;

(28) the Diluvial snow age; (29) prehistoric man; and (30) the course of the history of the earth.

This mere list of chapter heads is in itself an illustration of how far the trend of thought, and the interpretations of the author deviate from the old grooves of the traditional "course in geology." It is impossible in a short review to do justice to the many original points in the author's treatment of the various subjects. A few of the most interesting ones can only be mentioned.

I should like to draw special attention to the instructive way in which the thermo-plastic origin of the metamorphic rocks is explained as well as the formation of granites as a "cup of cinders" of the magma in which the basic components have sunk to the bottom—things which have been said before but hardly ever in a way comparable to the author's. Other chapters deserve the attention of the American student because the opinions expressed in them have not yet, to my knowledge, been adduced in American geological literature. Thus, for instance, the author's suggestion that rapid and frequent changes of facies in certain formations may be explained, not by as many oscillations of sea level, but rather by changes in the salinity of the respective seas, or by changes of the ocean currents which resulted in the transport and deposition of different deposits. The triassic sandstones, Professor Walther claims to be, for Germany at least, the product of a sand desert with shallow temporary lakes and pools, with short interludes of marine transgression, and a final overflooding by the Muschelkalk and Keuper seas. His arguments, too, in favor of a snow age in the place of the accepted ice age are worthy of notice.

As to the geological forces that produced the changes of the different periods, the author is as little an advocate of catastrophal theories as of perfect quietism. He says that, while on the whole, evolution went its way quietly through the different chapters of the earth's history, there must have been quasi "heroic" epochs, now and then, in which the action of geological and evolutional factors was accelerated, not by the increased activity of one of them but by the accidental, simultaneity of several series of causes whose effects not only added to, but also intensified, each other. Thus we see, at various times, that certain groups of plants or animals now one, now another, receive a certain impetus of a kind not now discernible to us, and begin to blossom out, as it were, into a profusion of both individuals and species. From the ontogenetic point of view, such periods of intensified vitality have an analogy, for example, in the life of the insect when, after long weeks and months of larval existence, it suddenly evolves into the butterfly. As normal phases in the development of species, these sudden climaxes should be called, not catastrophes, but anastrophes, and to discover the causes of this biological phenomenon the author designates as the paramount task of the geology of the future. He even hints at the possibility that the beginnings of life itself might be explained with the aid of a great anastrophe through which the indifferent initial forms suddenly developed new types, the ancestors of the living species of later ages.

The book, as has been said before, will be found full of interest for almost any reader; the layman will enjoy it as an epic of natural history; the novice in geology will prize it as one of the clearest expositions, from great points of view, of the problems of his chosen field; the mature student who has worked his way through the grind of the regular text book, will find it a new revelation on what he thought he knew, and the scholar and teacher will pay their respects to the

author who has shown what can be made of this subject by a master hand. It may not be amiss to say that no one with a tolerable reading acquaintance with scientific German need shrink from it for fear of linguistic difficulties. It is as readable as if it were a popular book, which I do not hesitate to set down as one of its merits. An extensive bibliography at the end of each chapter, an alphabetic index and three hundred and fifty-three illustrations of all kinds also facilitate its use. MARTHA KRUG GENTHE.

A Transformed Colony. Sierra Leona as it was, and as it is, its Progress, Peoples, Native Customs and Undeveloped Wealth. By T. J. Alldridge. xvi and 368 pp., 66 Illustrations, Map and Index. The J. B. Lippincott Company, Philadelphia, 1910. $3.50.

Mr. Alldridge was, for many years a British official in the Crown Colony of Sierra Leone. He is still the only man who has ever travelled around the entire area of what is now the Protectorate. In this interesting and authoritative book, he has pictured the past of Sierra Leone, as it really was; and then he tells of the wonderful transformation that has been brought about, the larger part of it within the past twelve years.

This book is representative of a new variety of works that is now being added to the literature on Africa. Four or five of these books have, thus far, appeared, and they could not have been written until this time. They contrast the former state of things with the present changed conditions. They sum up, thus far, the results of the mighty efforts that the white race has put forth to begin the regeneration of Africa and make the continent more useful to its peoples and to the world.

No part of barbarous Africa more strikingly illustrates the progressive movement than Sierra Leone. Mr. Alldridge shows how that region has been transformed from a lawless and slave-dealing country into one of security and freedom. The reign of terror has passed away. The chiefs no longer exercise autocratic power over life and death. The entire Hinterland is embraced in the Protectorate. An excellent railroad has helped to bring a region nearly as large as the State of New York under complete official control. Hospitals are multiplying, the elements of civilization, as we understand it, are taking root and the government policy is to teach the natives "the Gospel of the Carpenter Shop," as Bishop Ingham calls it. We cannot read such chapters as those describing the government school at Bo, the Sierra Leone R.R., the revolution in trade, the Princess Christian Hospital, and others, without believing that the new order of things is a wonderful boon to the million or two of natives in Sierra Leone. The book is well illustrated and contains an unusually good map of the Protectorate, considering that it can be only approximately accurate, as detailed surveys are still lacking.

Adrift on an Ice-Pan. By Wilfred Thomason Grenfell. xxvi and 69 pp., and Illustrations. Houghton Mifflin Company, Boston and New York, 1909. $0.75, net.

This is Dr. Grenfell's story of his drift on an ice floe that had broken away from land when he was sledge-travelling on a mission of mercy. He was alone with eight dogs, on an unsettled coast and his situation, for many hours, seemed hopeless. Relief came at last, but not till three of the dogs had given their lives

to save the man and their fellows. It is a record of endurance, courage and resourcefulness in the face of gravest peril and it shows the qualities that have enabled Dr. Grenfell to accomplish the work he has done.

Die Polarvölker. Von Dr. A. Byhan. 148 pp., 16 Plates, 2 Maps and Index. Quelle & Meyer, Leipzig, 1909. M. 1.25.

This little book, by one of the leading members of the staff of the Hamburg Ethnological Museum, will be counted among the useful works on the Arctic regions. Its topic is the material and intellectual life of the inhabitants of the high north. The space limits require concise treatment, but the prevalent and characteristic aspects of the tribes are clearly and methodically sketched. The lands they inhabit are briefly described and then the author treats of the various groups of peoples and their distribution, their clothing and ornaments, their habitations, industries, weapons, trade, means of communications, social organization, laws, customs, religion, games, arts, symbols or writings, and literature. The plates vividly reproduce many of the phases of life and occupation among the tribes; and the two maps show their distribution, the southern boundary of reindeer, etc.

The Canadian War of 1812. By C. P. Lucas. 269 pp., 8 Maps, and Index. The Clarendon Press, Oxford, 1906. 12s. 6d. [A careful compilation of the chapter in Canadian history dealing with the war of 1812 and derived, as far as possible, simply from the official despatches, on both sides, relating to the war. The maps are facsimiles of those which were used in this contest between the United States and Great Britain.]

Nel Darien e nell'Ecuador. Diario di Viaggio di un Naturalista. Dr. E. Festa. xvi and 397 pp., Maps, and Illustrations. Unione Tip.—Editrice Torinese, Turin, L.10. [A noteworthy book by a naturalist whose travels led him among the settlements of the south coast of Darien, the eastern province of Panama, and also into the heart of the Ecuadorian lowland, up the valley of the Rio Grande, and along the high plateau on which Quito stands. The author's observations on the flora, fauna, people and conditions of human life are of value. In conclusion, he gives a list of his zoological collections.]

Notes sur la Médicine et la Botanique des anciens Mexicains. Par A. Gerste, S.J. 161 pp., Appendix. Imprimerie Polyglotte vaticane, Rome, 1909. [The cost of publishing this careful compilation of all that is known of the medical régime and the botanical attainments of the ancient Mexicans, was borne by the Duc. de Loubat.]

Handbook of British Guiana 1909. Comprising General and Statistical Information concerning the Colony. Edited and Compiled by Geo. D. Bayley. xxv and 697 pp., Map., and Illustrations. Dulau & Co., London; J. H. Stark, Boston, 1909. 5s. [A handsome volume with many photo-engravings and a good map; the first work of the kind issued by British Guiana. It gives a good idea of the geography, population, mineral, agricultural and other resources, commerce, industries and other aspects of the colony.]

Chile. A Handbook Compiled by the International Bureau of American Republics. 235 pp., Map, Illustrations, and Index. Washington, 1909. [A well printed and handsomely illustrated handbook with a very good map of Chile made by Stanford, London. The work will be useful because it is a good com-

pendium of many kinds of facts relating to Chile. It is one of the best handbooks that the International Bureau has yet published.]

India. Romance of History. By Victor Surridge. xii and 308 pp., Map, 12 Illustrations from Original Drawings in Color, and Index. Frederick A. Stokes Company, New York, $2.00. [A book for popular reading in which the author attempts nothing more than to tell entertainingly the story of the more romantic events and picturesque incidents that marked the gradual evolution of India to its present position.]

Indian Pictures and Problems. Ian Malcolm. xiv and 294 pp., and 50 Illustrations. E. P. Dutton & Co., New York, 1907. Price, $3.00. [A book of travel, finely and copiously illustrated, descriptive of the India of to-day, with discussions on India problems, such as frontier questions, famine administration, etc.]

A Study of Nieve Penitente in the Himalaya. Paper No. 2. By William Hunter Workman. 27 pp., and Illustrations. Spottiswoode & Co., London, 1909. [Reprinted from the *Zeitschrift für Gletscherkunde,* May, 1909, with some additions. Describes the eight varieties of nieve penitente which Dr. Workman observed in the Nun Kun, Hispar, Biafo and Skoro regions. The fine photo-engravings help the description of these ice forms.]

Osservazioni preliminari sul Terremoto Calabro Messinese del mattino del 28 dicembre, 1908. G. Martinelli. 11 pp., and Map. Tip. S. Giuseppe degli Artigianelli, Turin, 1909. [This paper by Dr. Martinelli of the Osservatorio Geodinamico, Rome, records the phenomena observed at a large number of places within the seismic area, with much attention to the movements of the sea and the destruction caused by earthquake waves.]

Fenomeni sismici calabro-siculi precedenti il terremoto del 28 dicembre 1908. G. Martinelli. 24 pp., and Sketch Maps. Società Tipografica Modenese, Modena, 1909. [Gives instrumental records and discussion of the earth movements in the Calabria-Sicily area for several weeks preceding the earthquake of Dec. 28, 1908.]

An Explanation of the Adjustment of Ships' Compasses. By Commander L. W. P. Chetwynd. Second Edition. 24 pp., and Illustrations. J. D. Potter, London, 1909, 2s. [Deals concisely and without employing mathematical formulæ, with the various causes of the deviation of the compass and the methods of overcoming them.]

Lehrbuch der Paläozoologie. Von Prof. Dr. Ernest Freiherr Stromer v. Reichenbach. I. Teil: Wirbellose Tiere. x and 342 pp., 398 Illustrations, Diagrams, and Index. B. G. Teubner, Leipzig and Berlin, 1909. M. 10. [An introduction to palæozoology considered almost wholly apart from the geological relations of the fossils described. Dr. Stromer treats as clearly as possible, of the best-known results of zoological research, especially as relates to the classification, anatomy, life and distribution in time and space of the seven groups of animal organisms, from Protozoa to the Crustacea and other Arthropoda considered in this work. The descriptions are clear, the illustrations are excellent and each section closes with a bibliography.]

Erdkunde für Schulen. Von Alfred Kirchhoff. II Teil: Mittel und Oberstufe. Fifteenth Revised edition. viii and 411 pp., Illustrations, and Index. Verlag der Buchhandlung des Weisenhauses, Halle a. d. S., 1909. M. 3.40. [The latest revision of one of the best German text books of Geography.]

CURRENT GEOGRAPHICAL PAPERS

AMERICA

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NEW MAPS

NORTH AMERICA

U. S. GEOLOGICAL SURVEY MAPS

ALASKA. (a) Relief Map of Central Alaska, showing distribution of Mineral Resources. 1 inch=120 miles. (b) Geologic Map of Kasaan Peninsula, Prince of Wales Island. 1 inch=1.57 mile. (c) Geologic Map of Copper Mt. Region, Prince of Wales I. 1 inch=1.25 mile. (d) Preliminary Map showing mineral resources of Prince William Sound Region and adjacent Territory from Resurrection Bay to the Copper River Delta. 1 inch=12 miles. [Symbols for copper, gold and antimony mines and prospects.] (e) Map of Southwestern Alaska showing distribution of known mineral deposits. 1 inch=70 miles. (f) Geologic Sketch Map of Cook Inlet region. 1 inch=68 miles. (g) Geologic Map of Coal Harbor Coal Field, Unga I. 1 inch=4.5 miles. (h) Map of the Region of the Wrangell and Nutzotin Mts. 1 inch=15 miles. [Symbols for mineral locations and trail.] (i) Geologic Map of Fairbanks District. 1 inch=2.6 miles. (k) Map showing distribution of Mineral resources in Iron Creek Region, Seward Pen. 1 inch=2.15 miles. [All black maps.] Bull. 379, "Mineral Resources of Alaska. Report on Progress of Investigations in 1908," by A. H. Brooks and others, Washington, 1909.

ALASKA. (a) Reconnaissance Map of the Middle Kuskokwim and Lower Yukon Regions 1:625,000=9.88 miles to an inch. [Brown contours.] (b) Geologic Sketch Map of the Innoko, Central Kuskokwim and lower-central Yukon Regions. 1 inch=45 miles. (c) Sketch Map of the Innoko Placer District. 1 inch=7 miles. Interval, 500 feet. (d) Map of the Ruby Creek District. 1

inch=4 miles. Interval, 200 feet. (e) Map of the Gold Hill District. 1:250,000=3.95 miles to an inch. Interval, 200 feet. [All colored maps.] *Bull.* 410 "The Innoko Gold-Placer District. Alaska, with Accounts of the Central Kuskokwim Valley and the Ruby Creek and Gold Hill Placers," by A. G. Maddren, Washington, 1910.

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Pilot chart of the South Atlantic Ocean, June, July and August, 1910. [Based upon the researches made and data collected by Lieut. M. F. Maury.]

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Meteorological Charts of the North Pacific Charts, April and May, 1910.

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BULLETIN

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THE CAVERNS AND PEOPLE OF NORTHERN YUCATAN

BY

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The northern part of the Yucatan Peninsula, instead of having the luxuriant tropical vegetation often found in countries of low latitude, is in reality a great semi-arid plain. The forests, nowhere dense, dwindle away in parts to a stunted "brush" barely supported by the scanty soil which only partially covers the underlying limestone rock. It is, indeed, to the porous character of this rock and the absence of pronounced relief, rather than to a deficiency in the rainfall, that the aridity must be chiefly ascribed. The porous, fissured limestone rock is like a thirsty sponge which soaks in the water with only less avidity than the hot sands of a desert. Under these circumstances, it is of interest to note that, before the Discovery, this region supported probably the highest civilization of the western hemisphere, and that the conditions of human occupancy at the present time are not wholly unfavorable.*

The great plain of northern Yucatan extends southward from the Gulf of Mexico as a gentle, even slope, at an average increase in elevation of about one foot per mile. To the northward it sinks almost as gradually under the surface of the sea, forming the great Yucatan Bank with a width of some 100 miles, beyond which it

* The writer's personal knowledge of the country has been gained from a trip made early in 1904, the principal object being the collection of zoölogical materials and data. The work was in the interests of the Museum of Comparative Zoölogy at Cambridge, and consisted of a stay of several weeks at Progreso, a few days at Merida and Izamal, and nearly two months at Chichen-Itza.

sinks rapidly to the great depths of the Gulf. There are no harbors on the coast and the shoal water of the Bank makes it necessary for large steamers to anchor some miles off shore, whence freight and passengers are carried back and forth by lighters. Steamers must be ever in readiness to seek deeper water upon the approach of one of the dreaded "northers," those fierce storms that sweep from our southern states across the Gulf and down upon the unprotected coast. The coast itself is low, and, for 170 miles, skirted by a narrow sand reef, behind which lies an extensive lagoon of brackish water, which is called "el rio" and "la cienaga," and which opens to the sea at the west. At only two or three places along the entire reef do tidal inlets occur.*

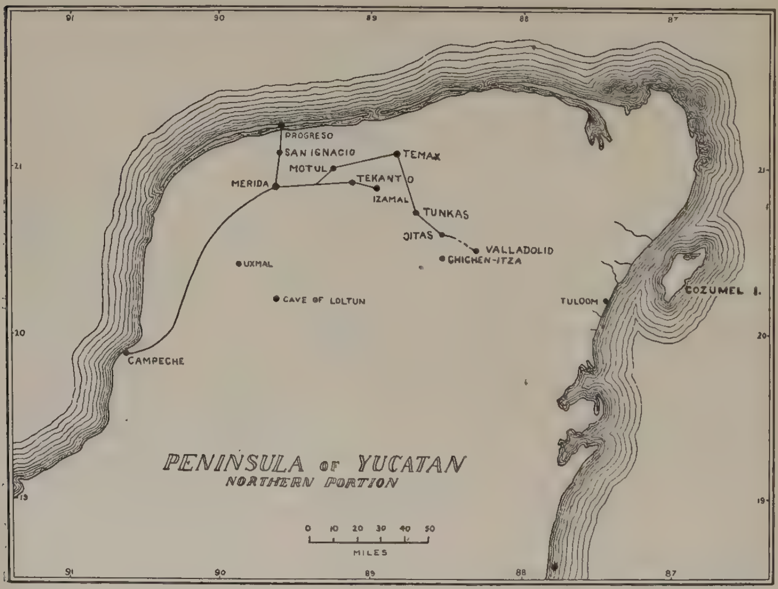

FIG. I.

By the courtesy of the Museum of Comparative Zoölogy, Cambridge.

To the southward of Merida, about 50 miles from the sea, the land rises in the form of a series of low hills, locally known as the "sierra," which have a general trend from northwest to southeast. Their average height is 400 or 500 feet. According to Mr. E. H. Thompson, in the neigrborhood of Xul, they reach a greater elevation of nearly 900 feet (Heilprin, 1892, p. 136). The extent of

* The method of formation of this coastal strip of sand and the consequent lagoon has been ably discussed by Schott (1866).

this range of "mountains" to the southeastward is not accurately known.

At San Ignacio, about half way between Merida and the coast, the general surface appears to be almost as flat and level as a floor; and here one may look for miles, with almost unobstructed view, across the enormous plantations of henequen, the plant which supplies the "sisal" fiber of commerce, and which constitutes one of the greatest sources of wealth in Yucatan. South of Merida, however, the dissection of the plain has progressed further, and the

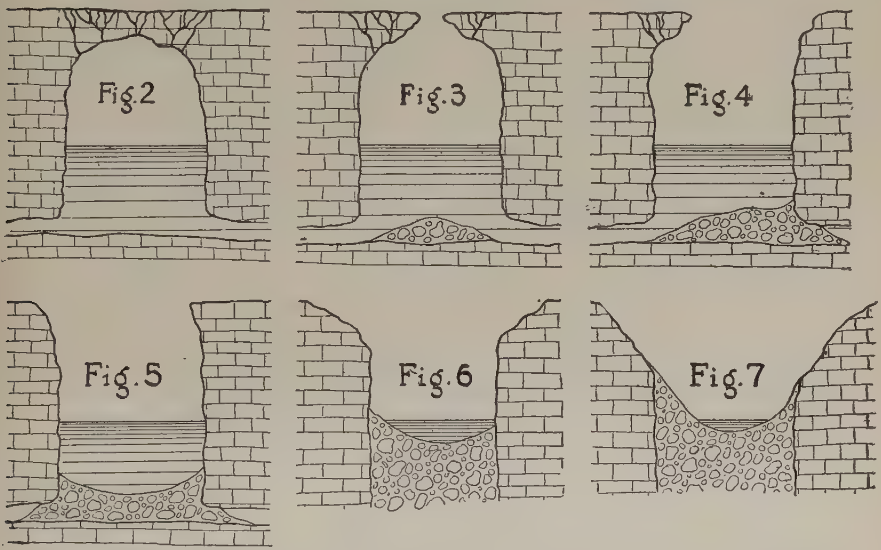

FIG. 2—Dome-shaped cavern, the roof of which has not yet fallen in; 3. A later stage in which the middle of the roof has given way; 4. Most of the roof has given way, but a portion still remains; 5. The typical cenote with vertical walls (see Fig. 7); 6. A later stage in which the walls are being worn back; 7. A topographically old cenote or "aguada" resembling a kettle-hole with a pool at the bottom.

surface topography is much more irregular. On account of the porosity and fissured surface of the limestone that constitutes the country rock, the heavy rains of the wet season cut irregular channels or "arroyas," whose positions are dependent upon the local conditions; but nowhere are these of any great length or permanency. For it should be understood that nowhere in the whole northern half of this great peninsula are there rivers or permanent surface streams, with the exception of a few short ones on the eastern coast; and these, as will be shown later, were probably underground streams whose roofs have fallen in. But in certain parts of the country

there are more or less permanent pools or "aguadas," and water is also to be found in deep caverns and sink holes. Many of the latter are of a peculiar chimney-like structure, and are known as "cenotes." It is with the nature of this underground drainage that the remainder of this paper will be chiefly concerned.

The rainy season in Yucatan is from about July to October. During the rest of the year the rainfall is small, though there may be occasional heavy thunder showers. In all parts of the country, the surface water quickly finds its way underground, and in the hill region it has formed many caverns and subterranean passages, which, if we may judge from the descriptions of those who have explored them, are similar in most respects to the caverns of any elevated limestone region. There is one peculiarity, however, which appears to be rather characteristic of the Yucatan karst, and that is the prevailing vertical character of the underground caverns. In the lower north country horizontal tunnels appear to be entirely absent, or at least very unusual; in the caverns of the hill region they do occur, but are very limited in comparison with such caverns as the Mammoth Cave in Kentucky. In the neighborhood of San Ignacio, between Merida and the coast, are to be found numerous small, round, vertical, shaft-like holes which remind one forcibly of glacial moulins.

The Cenotes

"Cenote" was the name given by the ancient Mayas to the deep waterholes or sinks of Yucatan; and since the character of these peculiar sinks appears to be distinctive, it may be well to retain the name, especially for the deep, circular, vertical-walled holes, without lateral passages, which may be considered as the type of the mature form. Varieties are to be found in the topographically younger dome-shaped caverns, with roofs intact, and the mature "aguadas" with sloping sides.

In presenting what the writer believes to be the most plausible explanation of the somewhat unusual features of Yucatan hydrography, it may be well first to describe what may be taken as the typical cenote, and then by other examples to illustrate their probable cycle of development.

The two well-known cenotes at Chichen-Itza may be taken as examples of what we may consider as typical. But although these have been so long known, and so often described, it is surprising how inaccurate are most of the dimensions that have been given.

The larger of these is known as the Sacred or Sacrificial Cenote because of the fact that, according to legend, and as has recently been confirmed by dredgings, it was a part of the Mayan religious ceremonies to cast into this deep pool human sacrifices who were to intercede with the gods of water for a plentiful supply of that much-needed element. This cenote is nearly circular in outline, with a diameter of 190 feet, while its walls, which are in places vertical, and locally overhanging, are 65 feet high from the level of the water to the general surface of the ground above. It is thus like a great circular shaft or stone quarry with a pool of water at the bottom. This water, which is fresh, is 36 feet deep and occupies the whole diameter of the shaft except at one point where there is a narrow beach. Its dark greenish color is not due, as stated by many, to its depth, nor to the overhanging vegetation, but rather to the microscopic algæ which grow in it. While the side walls have been spoken of as vertical, they are not straight and smooth, but are

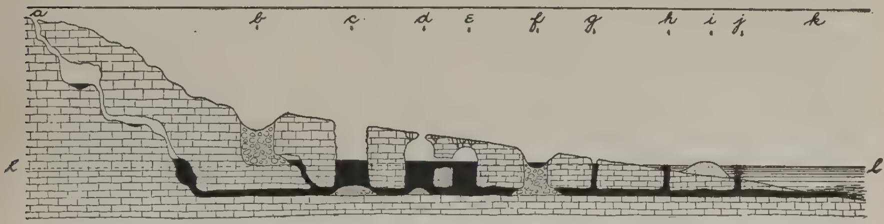

FIG. 8—Schematic North-south section from the "sierra" to the coast illustrating types of cenotes and caverns, relations of water level, subterranean connections, etc. *a.* Hill cavern, with long passages and pools of water held in impervious depressions; *b.* An old age cenote ("holla") holding water only temporary after rains; *c.* Typical cenote (see Figs. 5 and 9); *d* and *e.* Young cenotes or dome-shaped caverns (see Figs. 2 and 3) connected by a passage at water level; *f.* Old age cenote with permanent pool of water ("aguada," see Fig. 7); *g.* Water-hole near the coast, when water level is very near the surface; *h.* Fresh-water spring in a brackish lagoon or "cienaga"; *i.* Coastal sand reef on which coastal towns are located; *j.* Fresh-water spring a short distance from shore; *k.* Gulf of Mexico; *l.* Sea level.

composed rather of a series of projecting ledges apparently due to the varying hardness of the slightly northward-dipping strata. Figure 4 is a diagrammatic section of such a cenote.

The so-called Great Cenote has in reality a somewhat smaller diameter at the water surface than the other, but it appears larger because of its sloping walls. The walls are, however, except on one side, practically perpendicular for a considerable distance from the water, above which they slope back until they attain the ground level (Fig. 5). On one side there are remains of a ruined stairway; for it was this cenote which supplied the inhabitants of the ancient city of Chichen-Itza with water.

An examination of some of the other cenotes in the vicinity of Chichen-Itza and elsewhere, furnished an explanation of the mode of origin. At Pisté, a small Indian village but a short distance from Chichen-Itza, the village well, after going a few feet through solid rock, opens out into a large cavern with water at the bottom. The depth to water appears to be about the same as in the cenotes at Chichen, and, as nearly as could be judged, the diameter also approaches similar dimensions. Here, then, we apparently have a cenote which is entirely roofed over, the well above mentioned being artificial. This condition may be represented by the diagram in Figure 2.

About three miles east of Chichen is a cenote known as the Ikil. This was apparently, at one time, like that at Pisté, but the roof over the greater portion of it has fallen in, leaving at present a partial roof over two sides. Here again advantage had been taken of the overhanging roof to construct a well for drawing water. Figure 3 may be taken to represent a section of the Ikil cenote as in an intermediate stage of development in which only the central part of the roof, the top of the dome, has collapsed. There is a story that in the plaza of a certain Yucatan town a horse and rider once disappeared suddenly from sight by the breaking in of the roof of one of these subterranean caverns. Whether or not that story can be credited, Dr. Gaumer, long resident at Izamal, is authority for the fact that workmen, in digging a well at Motul, broke through the top of a great dome-shaped cavern and lost their tools. Many wells in Yucatan are thus situated over underground caverns.

There can apparently be little doubt that these peculiar water holes were formed, in the first place, by the solution of the rock, so as to make great underground dome-shaped caverns. The surface rock, as is common in limestone regions, is much harder than that below. The water therefore makes its way down through crevices in the resistant upper layer causing comparatively little solution; but when it encounters the softer strata below, its solvent power is exercised and large caverns with roofs intact are the result. In the walls of the Sacred Cenote at Chichen some of the lower strata are so soft that the rock can be crumbled in the hand almost like dust. The essentially horizontal position of the strata may be another important factor in giving the cenotes their vertical walls and few horizontal passages. The dip of the strata is so slight that it has probably been easier for the water to work its way directly down than to run off laterally. Either by the too great extension

of the cavern or by the gradual sapping of the roof, the latter eventually collapses, and the cenotes, such as have been described, are the result. One has but to witness the effects of a heavy tropical thunder storm upon the steep walls of one of these cenotes to realize how important an agent is erosion in their subsequent development; and considering the number of stones that go rolling down even during a brief storm, it seems strange that the walls are not worn back faster. They wear back first at the top, the lower part of the wall

FIG. 9—The Sacred or Sacrificial Cenote at Chichen-Itza. (Photo by E. H. Thompson.)

remaining vertical (Fig. 6); but the process of wear is continued until the cenote consists of a pool of water at the bottom of a funnel- or basin-like depression (Fig. 7). The twin cenotes of Shkolak (Xcolac) and Skashek, about two-thirds of the way from Izamal to Tunkas, would appear, according to the descriptions of Baker (1895) and Charnay (1887), to belong to this stage. In some cases the bottoms appear to have become entirely filled in, and such depressions then hold water only temporarily after rains.

THE UNDERGROUND DRAINAGE

There appears to be a common belief in Yucatan that the water which sinks into the rock gathers into well defined subter-

(FIG. 10—The Great cenote at Chichen-Itza. Owing to the wearing back of the walls, the vegetation has better access to the water and is more luxuriant. (Photo by E. H. Thompson.)

ranean rivers, which in turn empty into the sea. The reasons brought forward in support of this view may be briefly summarized.*

* Many of the facts and ideas here expressed are on the authority of Dr. G. F. Gaumer, an American physician who has for many years resided in Izamal.

In the first place, it is to be noted that the water in the cenotes is fresh and sweet as a rule, and it is argued that if they were not in some way connected with underground streams it would become stagnant and foul. It should be borne in mind, however, that in many countries, even in the tropics, water is often stored in cisterns for long periods and remains reasonably sweet. Another argument is that the water level in the cenotes remains fairly constant, having only minor fluctuations corresponding with periods of rainfall and drought, showing that the waters must have a ready escape. Cases are known in which neighboring cenotes are actually connected, the connection being in some cases (as at Motul) below the surface of the water.

Boys have sometimes thrown in gourds and hats, which have later been recovered from another well. In 1900 a domestic duck fell into a well (which opens into a subterranean cavern) at Izamal, and the following day was taken out of a well some one-fourth mile to the north. Izamal is probably situated over a great subterranean river; a line of important towns can be picked out which mark its course from the southern hills to the Gulf.*

Further evidence of subterranean streams is furnished by the numerous "boiling" springs along the north coast. Many of these open into the coastal lagoon while others open out in the salt waters of the Gulf itself. This water bubbles up from the bottom of the "cienaga" through holes from 6 to 15 feet in diameter, in which the sand is constantly agitated. Ober (1884) states that a fresh water spring in the Atlantic has long been known off St. Augustine, Florida, and quotes Humboldt as follows, regarding their occurrence on the Yucatan coast:

> On the northern coast of Yucatan, at the mouth of the Rio Lagartos, 400 meters from the shore, springs of fresh water spout up from amidst the salt water. It is probable that from some strong, hydrostatical pression the fresh water, after bursting through the banks of calcareous rocks between the clefts of which it has flowed, rises above the level of the salt water.

As Ober says, Florida and Yucatan are of similar geological formation, which may account for the appearance of these springs on the coasts of both peninsulas.†

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* On the authority of Dr. Gaumer.

† Ballou ("Due South, or Cuba past and present") wrote in 1885 that much of the drinking water, and certainly the best in use at Nassau, as well as at some of the neighboring islands, was procured from fresh water springs bubbling up through the salt water. He says the same is true also on the shores of the Persian Gulf. In the former case, the water was brought to the surface through barrels filled with sand, while in the Persian Gulf divers go down with leather bags which they open over the bubbling fresh water springs at the bottom. Hitchcock (1905) mentions fresh water springs in the ocean on the volcanic shores of the Hawaiian Islands.

The coastal springs mark the mouths of underground rivers, and the villages in their vicinity are the terminal ones of the lines that mark the courses of the streams from the hills to the sea. The inhabitants of these coastal villages, in some cases, place hollow tree trunks in the holes of the sea floor through which the water gushes, thus leading it to the surface of the Gulf without commingling with the salt water. They, in this way, obtain their supply of fresh water by going out on the Gulf in canoes! During times of storm, when the Gulf is too rough for canoes, it is necessary to go inland

FIG. 11—Scene in Citas, a village 30 miles north of Chichen-Itza. Shows scanty soil and characteristic vegetation. (Photo by E. H. Thompson.)

a mile or more across the "cienaga" to get fresh water. All the towns along the north coast, except Progreso, are said to be located where these subterranean streams open.

At Ascension Bay, on the east coast of the Yucatan peninsula, one of these rivers, 30 feet wide, has its roof broken in for about a mile inland, and, for this distance, runs between vertical walls not over three feet high. This probably represents the type of drainage in all the peninsula, merely differing in the fact that the roof of the once subterranean stream has here given way.

Another noticeable fact is that in most and possibly all of the cenotes in the more northern part of the peninsula the water stands at a common level. The available data as to altitudes and depths of the cenotes to water level are so incomplete and inaccurate that a consistent table cannot at present be prepared; but the bulk of the evidence seems to indicate that, in all of those cenotes north of the

Fig. 12—Scene in front of the "hacienda" at Chichen-Itza. (Photo by E. H. Thompson.)

"sierra," the water stands at a level only a little above that of the Gulf. The land surface rises on an average of about a foot to the mile and, making allowance for local irregularities, the distance in feet from the surface to the water level, at any particular point, is approximately the distance of that place from the Gulf in miles. Thus we find that close to the coast the water lies very near the

surface. Merida is 25 miles from the coast; according to Schott (1866), and Heilprin (1892), its altitude is 28 to 30 feet, and, on the testimony of the same authors, the water in the cenotes is some 26 to 30 feet below the surface. Other striking cases of agreement might be adduced, but these will suffice to illustrate the point.

There are two ways in which we may account for the maintenance of such a condition of the karst water. Either there are connecting passages between the different cenotes below the level of the sea, or else the rock at that level is so porous that the water can traverse it easily, or there may be a combination of these two conditions. Some of the evidence for believing that these are real subterranean streams has been given above. Against such a view must

Fig. 13—Henequen plantation at San Ignacio. (Photo by L. J. Cole.)

be put the fact that in two cenotes only some three miles or so apart, entirely different species of catfishes were found living, although the general conditions seemed much the same. In one of the cenotes, however (the Sacred Cenote), the water was only 36 feet deep, while in the other (the Ikil) a sounding line was lowered to 95 feet below the water surface! Such being the case, there can be no doubt that extensive subsidence has taken place in the Yucatan peninsula since its principal drainage features were formed; for in no other way can we account for the great depth of this cenote below the level of the sea. At one time the land must have stood at least 95 feet higher than it does to-day. At that time, the drainage conditions were probably similar to those found in any ordinary limestone region, with long horizontal tunnels and caverns, some distance above sea level, and vertical shafts leading down to them. Subse-

quent subsidence carried the horizontal passages below sea level, thus gradually raising the level of the water in the vertical shafts, but maintaining practically the same height all over the peninsula.

FIG. 14—A native wheel, with buckets, for drawing water. (Photo by E. J. Thompson.)

While it is possible, then, that there exist actual underground rivers, they are in most cases more than that, for they are actually below the level of the sea as well, and are to be looked upon as connecting tunnels completely filled with water rather than as real

streams. There were, however, undoubtedly in some cases, horizontal passages at higher levels, which might not yet be entirely "drowned," and which would account for the transportation of floating objects such as hats, etc., as already described. In other cases no doubt the caving in of the roofs and the accumulation of débris has blocked the passages from many of the cenotes, the water now having to make its way out by seepage. This would account for the comparatively shallow water in some of them, and also the restricted distribution of certain species of fishes.

In the hill region the drainage system is still largely above the sea level, and it here presents the features more commonly associated with limestone caverns. Here there are more lateral passages that can be traversed, but though, here and there, water may stand in impervious pools, the lower levels appear to be practically coincident with that of the sea. In Figure 8 an attempt has been made, by a schematic north-and-south cross-section from the hill region to the Gulf, to represent the principal features of the Yucatan karst which have been so briefly outlined.

Relation of Hydrographic Conditions to People

The natural semi-aridity of northern Yucatan is accentuated by the fact that the soil covering the rock is in many places very scanty. The semi-arid quality is especially marked during the day season, when many of the trees lose their leaves and the general appearance of the forests reminds one strongly of our own forests in early spring or late fall; and many of the native birds migrate to the southward from the peninsula, just as many of our birds go south (some of them to Yucatan) during the winter months.* The failure of the soil to retain moisture also limits very closely the kinds of crops that can be cultivated successfully. It is true that during the rainy season many garden crops may be grown successfully, but the two most important products of the country are corn and henequen. Sugar cane is cultivated to some extent. The raising of cattle is limited by the scarcity of forage, while the leaves of certain trees have to be gathered for the horses in place of hay.†

As to the corn and henequen, the former is all consumed in the country, the latter is practically all exported as the crude fiber. The method of raising corn employed by the natives is dependent upon

* Some evidence for such a migration has been presented by the author (Cole, 1906, p. 112) in the introduction to a paper on the birds of Yucatan.

* The stock can be turned loose and does not have to be herded during the day. It cannot get to the water in the cenotes, and consequently has to return to the tanks in the corral.

the weather conditions, and is very impoverishing to the soil. At the close of the dry season, the Indian prepares his "milpa" or corn-field by burning the timber from a tract of land, which is then planted in corn when the rains begin. A good crop is dependent upon plenty of rain. Corn is the staple food and a scarcity of this cereal, due to a bad season, is a serious matter to those living at a distance from the towns.

Henequen is grown on the dry, deforested plains, especially of the northwestern section. It is the staple product of the country, and the demand for it, created by the shutting off of the supply of manila fiber from the Philippines during the Spanish-American war, returned princely fortunes to the class of Yucatecans who own the enormous henequen plantations. As a consequence Merida is a city of life and gaiety, and has been referred to as the Paris of America.

There seems to be no evidence for believing that the climatic conditions in Yucatan were any different at the time the Maya civilization was at its height than they are to-day, and it seems remarkable that so high a state of culture and civilization should have arisen under conditions which seem in many ways so unfavorable.

Although it is believed that the ancient Mayas built reservoirs for the storage of water, they apparently did not know how to dig wells to obtain it. It is accordingly found that all their important cities were situated where there was access to the aguadas and cenotes, or to the caverns of the hills, the floors of some of which have been worn smooth by the generations of bare feet that have gone down into their depths and toiled back with the day's supply of water. Mention has been made of the fact that, on the northern coast, the villages are located in intimate relation to the supplies of fresh water. With the advent of the Spaniard came a knowledge of well digging. It is said that good water may be obtained by sinking a well almost anywhere. In ancient times the water was brought up by hand; later it was drawn from the wells by ropes and buckets; and sometimes, at the deeper wells mules were employed for hauling it up; but now windmills have been introduced, and as there is usually plenty of wind, these do the work economically and well. The city of Merida and vicinity is, when viewed from a slight elevation, a veritable forest of steel windmills of American make.

The dry climate of Yucatan, with its cool nights, has a decided influence on the conditions affecting health. It is much healthier

than most countries lying so well within the tropics, and lacks almost entirely the terrors of the "tierra caliente" of Mexico proper. Yellow fever is endemic, it is true, but apparently has seldom or never been very prevalent, and Casares (1906) is authority for the statement that it has now "been almost completely expelled." The fishes in the cenotes and larger pools keep the mosquito larvæ largely exterminated there, and a little systematic effort would do much to exterminate them in the temporary pools of water which are held in hollows in the rock for a few days after a rain, and which are quickly taken advantage of as breeding sites by the mosquitoes. In certain regions, where there are open aguadas, malaria and dengue fever are a serious menace, especially to foreigners; but here, also, a consistent crusade against the mosquitoes would undoubtedly better conditions. This should be comparatively easy in a karst country where the greater part of the water quickly disappears underground.

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UNDERGROUND ICE IN NORTHERN ALASKA*

BY

V. STEFÁNSSON

Three boat journeys of some 150 miles each through the delta of the Mackenzie River have shown no case of ice outcropping in the cut banks of the alluvial islands; neither have various winter trips through the same territory and eastward to Cape Brown revealed the presence of underground ice. That it does not occur in any of the exposed banks cannot be safely inferred, however, for it is often inconvenient to follow the land closely when travelling by sea or along wide rivers. Snow or talus may cover one month what would be visible the next. West of Herschel Island, underground ice is more frequently seen and the most casual observer can hardly avoid noticing the frequent and conspicuous outcroppings along the mainland coast and island chains from Flaxman Island west to Wainwright Inlet, the western limit of the writer's observations.

Everywhere along this stretch, perpetual frost is near the surface of the ground even in late summer. The distance down to it, at the end of August, varies (where the sun has free access) from 4 inches on level, damp, moss-covered flats to 2½ or 3 feet on sandbars that are dry and favorably located. Most years, the deepest snowdrifts on the north side of sloping hills will disappear completely, but some remnants of the larger ones persist, as many did the past summer (1908). In deep ravines, snow or ice frequently last through from year to year, even near sea level, though according to the Eskimo, an exceptionally rainy summer occasionally carries off drifts that have lain for five or more years.

The appearance of the outcropping ice is various, whether it occur along the seashore or in river banks, but in 3 things it seems to agree: there are no large, continuous ice sheets; the ice probably nowhere attains a great thickness; the earth on top of the ice is seldom if ever thick. The greatest thickness observed is less than 8 feet, while the average thickness of the surface layer is not over 2½ feet.

A sled trip in late September and early October, 1908, from the

* The observations that are the basis of this paper were made, at various times, between July, 1906, and February, 1909.

bottom of Smith Bay to Flaxman Island gave opportunity for observing ice outcroppings along the arctic shore. Probably half of this coastline consists of vertical banks which the sea is, in many places, rapidly undercutting and wearing away and these we had to follow closely, as the sea ice was not yet strong enough to allow our cutting across the small bays. There were 3 or 4 inches of snow on the ground and it was nowhere banked against the land so as to hide the face of the cliff from view.*

In many places one may follow a cut bank for miles without seeing underground ice and then come upon it without warning given by a change in the height of the bank, character of the earth, or the trend or appearance of the coastline. There may be one, two or a few pieces of ice exposed in cross section, or much of it may extend for rods and miles; sometimes the ice is high enough in the

FIG. 1—*a*, *b*, *c*, ice outcropping from an alluvial bank, about 8 feet high, near Cape Halkett. Base of *a* and *b* not visible. *d*, water level; no beach.

bank to have its base exposed; sometimes the ice face extends down beneath the beach or water line. Sometimes the ice is so nearly continuous and so nearly of even height in the bank that it seems not impossible that the breaks in it may have been produced by rivulet erosion. But if that be the case, the rivulets have been so completely filled with earth that there is now no trace of them in a uniform cut bank.

What comes as near, as anything I know, to being a continuous ice sheet,† 4 or 5 miles in extent, is found running north along the beach from Wainwright Inlet. Unfortunately, my own observations here are of little value as I have visited the locality only in midwinter. I must depend, for a description, upon the U. S. Government teacher at this place, Mr. J. E. Sinclair. Ice is also exposed near the Government coal mine on the Inlet itself, some six miles away; of this I present a diagram drawn by Mr. Sinclair.

Along the sea beach the ice is exposed so continuously that it had impressed Mr. Sinclair as a continuous sheet, cut here and there

* The cut bank varies in height from 5 to perhaps 20 feet. The highest are those east of Smith Bay.
† See discussion further on of ice house dug into this "sheet" of ice.

by small ravines, and covered in many places by talus. Where the base of the ice was exposed its thickness was nowhere over 9 feet, while at others it was only 3 feet.

In three localities, known to the writer, deep artificial excavations have been made into or through underground ice—at Flaxman Island, Point Barrow and Wainwright Inlet.

At Flaxman Island an ice house, for cold storage of food was dug on level tundra. The island is low and fairly level, probably nowhere rising much over 20 feet above the sea; perhaps a fifth or sixth of its surface is now covered with fresh water ponds. Small stones and some good-sized boulders are found on the surface, sometimes directly above beach outcrops of underground ice.

The excavation of the ice house was first through over 2 feet of soil and then through 6 feet of ice. This ice had grains of sand in

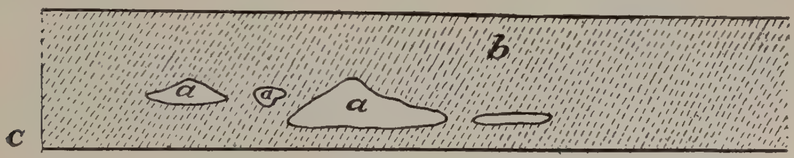

FIG. 2—Section of a cut bank, 12–15 feet high. Bank (*b*) composed of peat mixed with earth. *a*, *a*, *a*, ice apparently free from earthy impurities. Largest piece has a horizontal exposure of 12 feet and a vertical height of 5 feet.

it and fragments of rock, some rather larger than a coffee bean. Below the ice the excavation was continued a foot or two into earth of a similar character to that above the ice.*

At Cape Smythe, near Point Barrow, where an ice house was dug, the excavation was some 10 feet deep and was through earth except in one corner where a block of ice was so situated that rather less than one-fourth of the ice house is dug in ice.

The general character of the other ice houses at Cape Smythe is similar to that just mentioned, though some of the excavations answer fairly well the below detailed description of the Government ice house at Wainwright. Others, dug near ice houses in ice, show no sign of anything but sand or gravel. The deepest excavation is that dug by Lieut. Ray's expedition to a depth of over thirty feet. In the walls of this no signs of ice are found. An interesting feature of this shaft is that 3 feet of salt water stood unfrozen in its bottom for years, while six feet above, the cold was intense enough

* This description is admittedly loose. It is taken from a verbal account by one of the workmen who dug the ice house.

to keep deer meat continually frozen summer after summer. This shaft is about 100 yards from the ocean beach, while the surface of the water in the bottom of it seems to be a little below the level of low tide. The gradual drying of the walls and the resulting crumbling of the sand have filled the bottom of the shaft.

The general surface characters of the land around Cape Smythe are much the same as those of Flaxman Island—level land only a few feet above sea level.

Near the U. S. Government school, two miles north of Wainwright Inlet, an ice house was dug through about 3 feet of earth and 7 or 8 feet into the ice. A hole three feet deep at the bottom of this ice house failed to penetrate the ice, so this gives a thickness of something over 11 feet—the greatest ascertained thickness known to the writer.

The appearance of the walls of this ice house is characteristic and, in my belief, typical of much of the ice that outcrops upon the

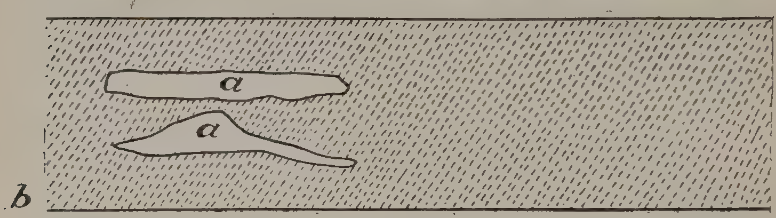

FIG. 3—Ice outcropping in alluvial cut bank near Pitt Point. *a*, *a*, ice worn level with face of bank. Upper piece about 15 feet long and 20–24 inches thick. *b* is beach level.

seashore. It should be solid ice, and ice of one kind generally, if it had been formed and frozen in its present position, but the fact is that it presents the appearance of a heap of fragments and blocks, of varying size pressed together. Neither are these fragments similar. They differ in some being "clean" ice and some "dirty;" they differ in color where they are apparently formed out of clean (not muddy) water; some are transparent, others milky; some of the dirty ice is discolored by foreign materials (muddy water ice), while some has clear layers alternating with discolored layers in a sort of stratification. Even these last may be re-classified into two groups—those which have their dark bands composed of "muddy water ice" and those in which the dark bands are not ice at all but earth—sometimes sand, sometimes peat.

Even a rough sketch of one of the walls of the Wainwright ice house gives a better idea of the character of the ice than would much

description. In some places, it seems as if smaller pieces of ice had been fused into larger ones by thawing, pressure and re-freezing. Some pieces seem to have been thin and to have been crumpled (not crushed) by lateral pressure so that their position in the ice wall is now indicated by wavy lines. And between and among all these heterogeneous ice blocks are fragments, layers and huge masses of earth. Here and there, also, are corners and crevices packed solid with snow, not large quantities, but a thimbleful here and a handful there. In some places this snow has been pressed and water-soaked so that it differs little from the rest of the wall in hardness; in others it is so soft as to be easily scratched with the fingernail.

Some of the thinner layers of earth in the wall of this ice house are sand and others peat, but the larger masses are entirely of fine sand. While some of these look as if they might have been in their

FIG. 4—Ice and coal outcropping at Government coal mine, Wainwright Inlet. *a*, *a*, hill slopes covered with grass and moss. *b*, clay and gravel talus. *c*, *c*, ice about 8 feet thick. *e*, blue clay. *f*, lignite, 4½ feet. *g*, sub-bituminous coal, 2½ feet. *h*, high water mark. The ice extends below the level of the beach.

present form at the time the ice was heaped up around them, others suggest that thin mud flowed into empty spaces, between loosely piled ice blocks, and froze there.

In several places, the ice house walls show frost cracks such as are found everywhere in frozen ground, but these are easily distinguished from the typical thin mud layers in the ice wall by the fact that the frost cracks are straight or harshly angular, in distinction to the flowing curves of the others, which suggest that they were formed by wind or water action.

The ice houses of Eskimos living at Wainwright show, in general, characters similar to those found in the Government ice house. One of them, though larger than the Government ice-house, shows no large masses of earth in the walls or floor, though the thin mud layers streak the walls here and there. In one corner, however, a significant thing is observable—an open space where none of four ice blocks had touched each other but had left a small pyramid-shaped chamber to which neither water, snow or sand had found access, evidence, apparently, that the pressure under which the ice was heaped was not strong enough to close all crevices.

It remains to outline four different processes by which the writer has seen underground ice formed. That there are other methods by which it is formed in this locality seems probable; that remote localities and remote times may have had others seems still more likely.

Formation of Underground Ice along the Seashore through Wind Pressure. Along a gravel beach running from Cape Smythe towards Point Barrow there were, in the summer of 1908, a number of mounds, the largest rising 12 or 15 feet above their base level

Fig. 5—Sketch of part of east wall (6 ft. by 6 ft.) of Government ice house, Wainwright. The vertical broken lines represent ice. *a*, *a*, *a*, masses of earth. *b*, *b*, sand with laminæ of ice between. *c*, *c*, pockets of sand. *d*, masses of snow, here and there, more or less compressed and some solidified into ice. *e*, thin layers of sand or peat. The ice at *f* seems to have been subjected to strong lateral pressure, hence the wavy lines.

and with a basal circumference of say 50 feet. Some were a considerable distance apart, others touched each other and formed a sort of double or treble mound. Scratching into these heaps with a stick showed that the main body of them was ice, with a covering of gravel. Tongues of ice had been thrust into the land. When the tide fell and the water retreated the main body of the ice broke away, leaving pieces, weighing tens of tons, in some cases, imbedded in the ground. It is probable, because of the thinness and porosity

of the gravel and the consequent penetration through it of every summer shower, that even the largest of these ice blocks will disappear in a few years and the beach resume approximately its former appearance.*

A gravel and ice hill similar to those just described is situated on the north coast about half way from Smith Bay to Cape Halkett. This hill, an Eskimo told me, was there six years ago and has not decreased noticeably in size. At the eastern entrance to Smith Bay

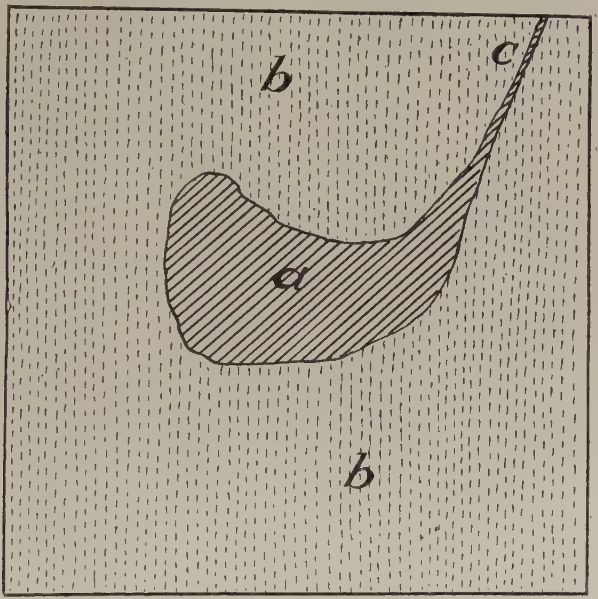

FIG. 6—Part of west wall of Government ice house at Wainwright. *a*, mass of mud that seems to have flowed into a cavity in the ice and frozen there. *b*, *b*, clear ice. *c*, crack through which mud flowed in?

are two similar heaps, but covered with peat instead of gravel. That their core is ice is merely inferential, for their outside was frozen hard. In my observation, 5 or 6 inches of wet peat will keep ice from melting through an ordinary summer. A foot or 14 inches of damp mud would serve the same purpose, though dry sand thaws down deeper. A typical ice block shoved in, as described above, would carry in with it not only dry snow but snow soaked with sea spray and frozen, while in the very centre of a cake might be found

* Some, apparently, persisted in former times, however, for the ice-house dug in the spring of 1908, of the Cape Smythe Whaling and Trading Co. was excavated through gravel mixed with boulders of ice evidently formed in muddy water, such as is formed in autumn along the beach when a southwest gale heaps muddy slush-ice in the shore water.

snow similarly frozen by a submergence, by pressure, of the ice cake while it was out at sea.

Preservation of Sea Ice Under Mud Deposited by Rivers. At the mouths of most arctic rivers, the sea is so shoal that it freezes to the bottom for a greater or less distance from shore. Sometimes the river, especially if one of considerable size, has an open channel to deep water somewhere all winter, but that does not alter the fact of there being much bottom-frozen ice near the river mouth. If the entire stream freezes to bottom we have winter overflows and water (muddy or clear) may flow at any time out over the older ice, so that the ice of a river, in cross section, shows, by spring, many layers of ice, now of muddier water, now of clearer, with more or less of snow-ice between. But whether this flooding happens or not, one overflow is certain, that of the spring break-up when the muddy river spreads for miles over the sea-ice near its delta. I have seen the mud layer deposited by the water, as it loses its current at the river's mouth, thick enough to preserve ice several inches thick into autumn of the following year; with favorable conditions, it seems that a thin ice layer of one year might be added to by a thin layer of the next, and thus ice deltas be formed much as mud deltas are in rivers. In certain shoal bays it seems not impossible that the muddy overwash by the sea in a storm might have a like effect.

Ice and Snow Preserved by Drifting Sand. On the Jones Islands (miscalled "Thetis Islands" on some charts) just east of the Colville delta, I found, in the summer of 1907, ice and snow under a few inches of damp sand. This was late in July, but it seemed to me evident that the snow and ice had been there more than one season. When the wind blew hard, sand drifted considerably on those islands and formed small dunes in places; judging from the dirtiness of the snow, at a considerable distance from the island, this winter (1908-9), it seems that sand drifts there to some extent at all seasons, so that a snowbank might get a considerable coating before spring and a much thicker one before the summer sun had thawed even the unprotected drifts near it. The drifting of sand and dust from the mud and sand bars at the mouths of rivers upon the ice near them is also a contributing factor in furnishing a preservative coat to the ice that sometimes persists there throughout the summer.

Ice Preserved by the Shifting of Channel of a Meandering River. In the banks of the Colville, there may be found ice out-

croppings, at least 25 to 40 miles from the river's mouth. This ice may have been formed and preserved as already indicated, but as ice benches along cut banks are frequently maintained late into the summer, even in locations not particularly favorable, and as sand bars are often piled up with astonishing rapidity in the arctic rivers, it seems not unlikely that one of these benches should now and then be covered with sand or mud sufficiently deep to preserve it indefinitely. Incidentally it may be suggested that the carcass of an animal (*e. g.*, a mammoth) would, in like manner, be indefinitely preserved if the beast were to die at the growing end of a sandbar in a river whose channel is shifting across a roomy floodplain.

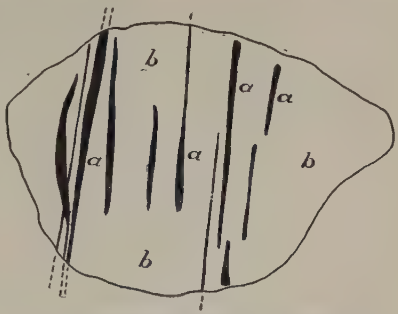

FIG. 7—A piece of ice chipped from wall of Government ice house at Wainwright. Half natural size. *a*, black earth of peat-like character. *b*, ice.

Finally, it may be noted that, both along the arctic coast and on the north flowing rivers, the comparatively warm water undercuts the vertical banks in numerous places. For this reason huge blocks tumble down every now and then. It might be supposed that these would fall down in summer invariably, on account of the undercutting at that season and the thawing of the ground. As a matter of fact, the thawing of a few inches on the surface makes little difference and the rapid undercutting may be credited with the fall of such banks as do fall. In winter, however, a sharp frost or sudden change of temperature often causes the earth to crack to a great depth.* If one of these cracks happens to be suitably located, it cuts off the projecting bank and it may tumble upon the ice below in mid winter. If other conditions are suitable, this huge bulk may protect the ice under it from melting, but it is of course more usual that the river or sea, the next summer, breaks up the mass and carries it away.

On Herschel Island, where, by the way, no underground ice has been found in digging numerous ice houses, and where none is known to outcrop, landslides frequently bury snowbanks and ice shelfs at the foot of a cliff, but this preserves them only a year or two, for, along the steep cliffs, the shoreline is continually receding.

* The writer has seen frost cracks in the mudflats of the Colville that are a hundred and more yards long, and wide enough so that a man occasionally stumbles by his foot slipping into them through the snow.

THE DEVELOPMENT OF COMMERCIAL CENTERS

BY

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Cities and trade are continually exerting reflex influence, the one upon the other, and to understand the large commercial movements, we must understand the economic functions and origins of the city.

The origin of the town goes back into the early history of the human race, to the days of the first permanent settlements and the first regular trade. The present day metropolis is but a town grown large, and the growth is a result of its trade and the same laws govern it and the same forces push it from its village beginning to its metropolitan ending.

The beginning of commerce is a trade or barter between two individuals. Each has a surplus of a particular article and they find mutual advantage in the exchange of the surplus. The most complex phases of present day commerce are but the outgrowths of this simple exchange of goods, complicated by the numberless wants of man, the variety in natural resources, the world-wide distribution of industry, and the myriad complexities of invention and manufacture.

The rise from barter to money and the expansion of trade to international proportions have produced many institutions. First and most fundamental among these is the trade center or distributing center. In primitive barter man develops so many wants that it becomes inconvenient to meet individually the various people with whom he wishes to trade, and some common meeting place is the result. Many previously disconnected individuals now have a place for common activity, some of them a place for common residence, and a market place, or fair, a village or town comes slowly into being. It is interesting to note, in this connection, that in many European cities this primeval plot of ground where the trading took place continues to this day as a market square, as in Antwerp, Brussels and many other cities now grown great. It is also to be found in many a small country town. The normal trading town is, therefore, manifestly and most naturally located in some spot easy of access, some spot with a natural superiority of access usually due to geographic causes. If these conditions of superiority of access are sufficiently far-reaching the settlement around this market place

becomes a city with international trade, for the market village and the metropolis are alike the products of economic forces that differ only in scope, not in kind.

In examining into the causes for the growth of commercial centers, one should note the distinction between industrial and commercial causes, between industrial and commercial cities. Examination shows that most cities have both commerce and industry in some degree. As a commercial city increases in population some local industries usually spring up. And similarly the growth of a manufacturing city usually develops some commercial activity. The mere numbers of people inevitably produce at least a certain minimum of trade and manufacture. But in the main, the city exists because it is either a commercial or an industrial center, the one activity being only secondary or tributary to the main one. In most cases it is easy to characterise the world's leading cities as belonging to one or the other of these classes. For example, Pittsburg, Pa., Birmingham, England and Lyons, France, will be classed at once as industrial cities. New York, Liverpool, Hamburg, and Hong Kong will be classed as commercial cities. The purest examples of commercial cities are to be met within the unhealthy seaports of the torrid zone where the conditions of life are so bad that only the most compelling of operations are there performed. Such a city is Santos, Brazil, or Puerto Cabello, or La Guayra, Venezuela. Here are centered the strictly port or commercial activities that must be by the water edge while in the much larger cities of São Paulo, on the wholesome plateau near Santos, and Caracas similarly situated near the Venezuelan ports, the manufacturing and residential functions are centered.

In other cities the commercial and manufacturing influences become difficult or even impossible of accurate discernment because political reasons have interfered with, or been added to the workings of economic forces. Where several cities have approximately equal natural advantages, the selection of one of them for a national, state or county capital will be the deciding factor that raises it far above its rivals. This force has made Paris and Berlin the great cities that they are, and the City of Washington, in a location fixed by statute and having neither manufactures or commerce, exists because it is the place of residence for the thousands employed in the administration of the Federal Government of a rapidly growing nation.

The commercial city or distributing center, its causes, and some

of the influences affecting it will be considered here. The industrial center and the political center will only receive attention as they bear upon commercial questions. At the present time, students, publicists, and lawmakers are devoting much attention to commerce. It is necessary that there should be a clear understanding of the way in which commerce, and particularly international commerce, is carried on and why it is carried on in certain cities. Without such an understanding, legislation in favor of commerce must sometimes miss its goal and expenditures for the promotion of trade must sometimes be made without results.

Some advantage in transportation is the most fundamental and most important of the causes determining the location of a distributing center. It may almost be said to be the only cause for the formation of such centers. For some reason, a particular place is more conveniently and cheaply reached by many people than any surrounding point and, as a result, they naturally exchange commodities there. The country store is located at the crossing of roads. There also is the village. In a mountain country the market town is at the junction of two, or, still better, of three valleys. Another favorite location is the end of a mountain pass or gap that is a thoroughfare between two valleys. If rivers are difficult to cross, a settlement will spring up at the safest ferries or fords. In a level plain, a town will be near its center, and a focus of roads or railroads in such a plain, fertile and populous, will almost surely make a city. Any one who is familiar with the geography of a country district can see examples illustrating any or all of these. The head of navigation on a river is a location far more commanding than any of those already mentioned. Here all the trade that goes by the river must be changed from one method of conveyance to another. Here goods are collected from the surrounding country for shipment by water. Here the people, who bring the goods, buy their supplies. Here also must be merchants, forwarding agents, and the repairers of wagons and ships. A town or even a city arises. It is interesting to note that towns of this class were relatively much more important in 1800 than in 1900. In the first-named year a river offered a much greater relative advantage for cheap transportation. Without water transport but few localities could support populous settlements. The alternative was the creaking and heavy wagon miring in the mud. The cost of carrying goods by wagon was so great that in a short distance it equalled the value of the goods and set a narrow limit to the territories that could engage in commerce. A navigable river gave its

valley an outlet to the sea, and the river port was a close rival in importance to the seaport. In 1900 the railroad carried most of the freight which 100 years before depended upon the river. As a result, many places of leading importance in 1800 had in 1900 become insignificant towns. The new means of transportation, namely, the railroad, have built up prosperous cities where under the old conditions cities were impossible. Examples of this shrunken importance may be found in abundance in the basin of the Chesapeake. With its many estuaries there were numerous ports of nearly equal size in 1800, when George Washington's Alexandria was an important and prosperous place. But Baltimore has long been the seaport of the Chesapeake, and Alexandria would not now make a good ward in the rival that serves her by rail with many sea-borne products.

The loss of the river port has been the gain of the sea port. The railroad train has rushed past the river port to the giant ocean steamer that cannot reach it. The most commanding location is the safe harbor which is, or may become, the natural outlet for a rich and populous territory. It has in greater degree and in greater extent the advantage that is to be found in the location of all the smaller distributing centers that have been cited above. It is a convenient place for the breaking of cargo. It is the extreme point that can be reached by the most favorable means of transportation and one where operations must begin on a smaller scale and by a more expensive method. Here the ocean steamer discharges its freight which is taken forward to its destination by smaller and more expensive carrying agents—the coasting vessel, the river boat, the railroad, and to some extent the wagon, and in some countries, even the pack train. The great sea port exists because it is a place for the breaking of cargo by ships, just as the country store exists because the wagon loads of miscellaneous supplies must there be divided up into numerous small packages for the individual consumer.

Sea ports are the focusing points of the commerce of both land and sea. Nearly all land commerce and land routes go to and fro between ports and interior points. All ocean commerce is a movement of ships and goods from port to port. What is a port, what makes a port? Any place where ships can unload, in safety, their goods upon the land may become a port, but such places actually do become ports because of their location with relation to adjacent, accessible seats of human enterprise. They rarely become ports because of any production within the port itself. The activity of

the port begins primarily because it has particular advantages of access to populous regions and also suitable access to the sea over which the commerce of the regions is to go.

It must be a point as far inland as possible so that the importer and exporter may have the largest advantage of the cheaper freights possible on large ships. Therefore the greater ports are at the heads of bays and gulfs rather than on peninsulas and headlands. The rugged west coast of Great Britain offers many bays and harbors for the shelter of shipping, but none of the small ports on projecting Cornwall can displace Bristol as the leading harbor of the southwest of England, for Bristol is far inland at the head of a bay. In the same way Liverpool, the great port of the west, has grown upon the indented coast of Lancashire, and not on some of the equally safe bays of the projecting coast of Wales. Similarly, Boston and New York are on bays that indent the main land, not on those near the end of Cape Cod or Long Island.

Besides easy access from the sea, the great seaport, the international trade center, must have easy access to the land and to the centers of population that it serves. This access is best supplied by a navigable river where there is also easy land communication over a level valley, besides the water transportation on the river itself, and on the canals that can be built most easily along water courses. Nearly all important seaports are at, or near, the mouths of rivers, navigable or otherwise, and in regions having navigable rivers the largest cities are in locations having the best communication with the interior. New Orleans, on the lower Mississippi, has been, from its settlement, the unrivalled metropolis of the coasts of the Gulf of Mexico. Philadelphia, Boston and Baltimore were the rivals of New York till the opening of the Erie Canal made the Hudson the outlet for the Great Lakes and of enormous territory in the center of the continent. With this advantage New York has gained a foreign trade exceeding that of all the other Atlantic ports combined. If the break in the Appalachians had been at the navigable head of the Delaware, the Susquehanna, or the James, the location of our great commercial metropolis would surely have been different. The improvement of the railway and the cheapening of rates have caused the Erie Canal to carry a declining proportion of New York commerce, but the level country through which the canal passes is also the most favorable for the building and operation of railroads. As in America, so in other continents the navigable river has dominated the growth of seaports. It is not by accident

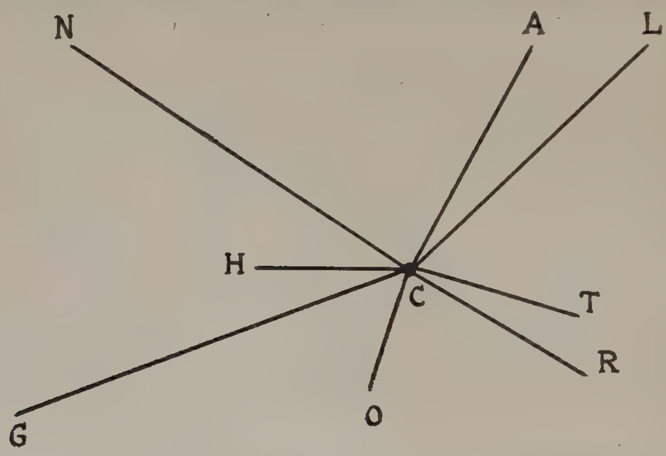
that London and Liverpool are upon the Thames and the Mersey with their canal connections with the interior. Hamburg has outstripped Bremen because the Elbe is navigable beyond the Austrian boundary, while the Weser gives Bremen but inferior communication with the "hinterland." The Nile has made Alexandria: the Ganges, Calcutta: the Yangtse Kiang, Shanghai; and Hong Kong, the island distributer for South China, lies directly at the mouth of the West River, the great highway of the southern provinces.

Some ports have a twofold commerce. Besides commanding the regions lying inland they are able to distribute, by sea, foreign goods to other ports or even to the ports of foreign countries. This is an important element in the growth of many cities, but a greater impetus in the development of seaports of the first magnitude comes from a large producing and consuming inland region that must use these cities as an outlet and inlet.

Being the distributing and supply point for such a region, the port has an excellent supply of raw materials, and becomes a favorable location for the establishment of manufactures. This is especially true of those industries requiring imported raw materials. To industrial development along this line is due a large share of the growth of all the larger seaports of the world. In addition to and distinct from this incoming and outgoing trade of the dependent and industrial districts, is the commerce of the second kind, the distribution of foreign goods to other foreign countries. Thus London and Liverpool, in the past, had a large commerce in articles that did not originate in England and were not intended for consumption in England. London was the largest distributer of foreign goods. The London merchant was a middleman in international commerce. Consequently, England gained in riches from this source, but the chief reason for the growth and prosperity of London was not her foreign distributing trade, but the commerce that came to her as the local center of a great industrial population and the commercial capital of the country where the most highly developed manufactures in the world fostered the largest import and export trade. The chief basis of a city's trade under modern commercial conditions is to be found in the industrial districts of which that city is the immediate distributer, and not in the business that comes to a city as a commercial intermediary. This intermediary, or distributing trade, national or international, is the second step in the development of a city. The first step is the establishment of many lines of transportation giving connection with the various countries engaging in

international trade. These are only built up and in the main supported by local demand and local production.

In the diagram let C represent a commercial city that succeeded in establishing direct connections with the scattered cities H, O, R, & T, and L, A, N, & G, because the industrial districts around C could in part at least consume the exports and supply the imports of these outlying regions. Once these lines of transit were in operation, it was found that the consumers of G wanted small quantities of the goods produced in T, A, or R, and that the people of T, A, and H wanted the products of G. This trade was small, and the cheapest way to carry it on was through the existing connections, via the center C, which in time became the emporium whence the



products of G and N were supplied to all the other countries, and whence G and N imported the assembled products of many lands.

This may look like wasteful method with useless travel, but the movement of goods may be in such small quantities that it would not furnish sufficient cargo to justify sending a ship from G to N. Such roundabout commerce is taking place to-day and has been taking place since commerce began. There are many places about the Gulf of Mexico and the Caribbean Sea that within recent years had so little commerce and hence so little transport connection with each other that the most convenient way for a traveller or freight to get from one to the other was to go via Europe or the United States. This has even been true between the neighboring islands of Cuba and Jamaica or Cuba and Porto Rico.

For C one may substitute, according to the period of which he

speaks, Venice, Bruges, Antwerp, Amsterdam, London, and to a lesser degree, New York. It will be observed that each of these cities was the metropolis of a dense industrial population and had important commercial activities of its own before it rose to the point of controlling the commerce of other countries.

One of the changes in the world commerce of the past century has been the pronounced separation of ports into classes. One class is the raw material port, and another is the manufactured goods port. The two are steadily growing more distinct at the present time. This has resulted from the vast multiplication of commerce in bulk which multiplication is in turn the result of the numerous industrial changes of the past hundred years that have come from the application of steam and electricity to so many of man's activities. World commerce has been made over in more ways than mere vehicles and means of propulsion and management. Its commodities have come down from the small bulk and high value goods such as tea, silk, furs, spices and luxuries to the cheap and bulky raw materials—grain, lumber, petroleum, ore, and the coarser fibers. Spices have gone to the tenth place even in the exports of India, but we use more of them than ever.

The filling of the channels of trade with the many bulky, cheap or perishable articles has produced new trade conditions with less dependence upon great ports and distributing centers. Cheap and bulky goods usually go to best advantage in full cargo lots, and as the vessel has to depend upon no other freight, it can load at any small port near the place of production. It is easy and profitable for a vessel to go to a small port of Florida or Georgia for a full cargo of phosphate or lumber, to a Chilean outport for nitrate of soda, to a West Indian outport for iron ore or bananas, to Cardiff, Wales, for coal, or to a convenient railway terminus in the Argentine Republic, for wheat.

A railway, a pier, and suitable warehouses may enable a small town to export raw material in bulk. The raw material port therefore may be, and usually is, a small port.

These goods may also be imported by a small port for use in local industries that do not require a large population for the manufacture and distribution of the products.

It may therefore be stated that trade in raw materials has a stronger tendency than manufactures to go direct rather than via intermediate ports and may often be exchanged between cities of small importance. In contrast to this, it is only a large city that

can import or export cargoes of highly manufactured goods. These articles are consumed in small quantities. Much choice is exercised in their selection and purchase by the consumer. The retail dealer must exercise similar care and discretion in the selection of his stock. He can do this best in a great wholesale market where he can go from place to place and take advantage of the competition and stock of many wholesale merchants. This is to be found only in a great city. This gives the city holding the trade in manufactured goods the conservative force that comes of its being known as a market. The trade in manufactured goods therefore continues to cling to the older distributing centers long after it is possible to make direct shipments.

The 19th century development has been not so much a revolution as a new growth. The old commerce of 1800, the trade in manufactures, spices and luxuries stays, much augmented, in the old centers, and the new commerce, in bulky raw materials, goes directly between small ports. This gives to the trade of almost all ports a one-sided characteristic which has a profound influence upon the ocean carrying trade. The greater number of the world's ports are either importing or exporting ports, but rarely are both of these activities centered in one port in anything like equal amounts. This is shown by an examination of this table which shows, for a recent year, the commerce of selected ports of the United States and United Kingdom, the value of imports and exports and the percentages that these bear to the whole movement of the nation.

	IMPORTS.		EXPORTS.	
	TOTAL VALUE MILLIONS.	PER CT. TOTAL U. S. OR U. K.	TOTAL VALUE MILLIONS.	PER CT. TOTAL U. S. OR U. K.
New York	$688	57.6	....	....
Boston	93	7.8	96	5.1
New Orleans	42	3.5	159	8.5
Galveston	5	.4	161	8.6
San Francisco	48	4.0	28	1.5
Puget Sound	22	1.8	44	2.3
London	£209	32.4	£123	23.7
Liverpool	160	24.8	165	31.1
Glasgow	15	2.3	30	.5
Plymouth	1.5	.2	.17	.03
Belfast	8.1	1.2	2.4	.4
Dublin	2.7	.4	.1	.01
Dundee	5.7	.8	.9	.1

New York and Boston, the leading Atlantic ports, adjacent to the greatest centers of population and manufacture are the cities with the oldest and best ocean connections. They are the leading ports of import and their percentages of imports exceed their export percentages. San Francisco, the old gateway for imports across the Pacific, has a still greater excess of imports and is in interesting contrast to the newer Puget Sound ports. The ports of the industrially newer and less populous South show the trade in raw materials cut off from the trade in manufactured imports. At Baltimore the exports are already double the imports, and at New Orleans the same conditions are visible in exaggerated degree. At Galveston, the newest of American ports, the ratio of exports to imports has recently changed a little from a ratio of about 100 to 1.

In exporting manufactured goods, there is the same tendency to cling to the old and great port, although the tendency is here weaker than it is in the importing of similar goods. The conservative force is the fact that manufactures usually go in small shipments of which many are required to fill a single ship. Add to this the fact that the shipper of goods of this class wishes as fast, frequent and wide-reaching sailings as possible, and it is evident that he can only get what he needs by doing business through the largest accessible port.

The United Kingdom, being a nation with import of raw materials and export of manufactures, thus reverses the commercial conditions of the United States. The table shows that her small ports reveal the same trade reversal, being importers of proportionately more goods than they export. Indeed, in several cases they export practically nothing and import considerable quantities of the raw products exported from the small ports of America.

Another way of classifying this same division of traffic is to say that the raw material port is the tramp ship port and the manufactured goods port is the line vessel port.

THE POLYNESIAN WANDERINGS

The Carnegie Institution of Washington has accepted for publication, and will promptly put to press, a very considerable volume presenting the results of inquiry into the migration of the Polynesians into the central and eastern Pacific. This is "The Polynesian Wanderings: Traces of the migration deduced from an examina-

tion of the Proto-Samoan content of Efaté and other languages of Melanesia." The author is William Churchill of New York City.

Now that this great work, by an American scholar, is to see the light under the auspices of the Carnegie Institution, it is especially interesting to note that the exploration of the ethnology and of the philology of the Pacific was in its beginning a work of American research. In Salem and in New Bedford, the return of the whalers yielded to students as rich rewards as came to the merchant adventurers in the cargo of bone and oil. This examination, by American scholarship, of the materials brought from the South Sea, culminated in the record of the scientific results of the United States Exploring Expedition under Wilkes and his corps of brilliant assistants. In this expedition Horatio Hale was the collector of the ethnographic material, and so well did he do his work that Latham characterized it as "the greatest mass of philological data ever accumulated by a single inquirer." But that was sixty years ago.

After that brilliant accomplishment, American scholars seem to have neglected the field in which preëminence had been won for their own country. The French, the English and now the Germans have been busy in the study of the languages of the Pacific, but since Hale, the Americans have seemed strangely neglectful. Now, after two generations, it may confidently be said that the leadership in the study of the philology of the Pacific has been brought back to this country.

In this volume of over 250,000 words, the author has subjected to rigid philological examination some 90 languages of Melanesia and has identified such element in them as they share with the Polynesian tongues. He has developed for each tongue its laws of phonetic mutation. The author brings further confirmation of his former discovery that the Polynesian has hitherto been wrongly classed by systematic philologists. He shows that it is properly not an agglutinative but an isolating speech. Particularly valuable is his massing of evidence to establish that here we find a language genesis, a speech in the making, all set plainly before the student in the examination of the evolution of consonant facility. Recurring to the position of John Crawfurd in 1847, but with a far greater mass of data, Mr. Churchill enters a strong plea for the dissolution of the once accepted family of Malayo-Polynesian speech.

It is possible to indicate here some of the major conclusions of the work:

Following out the line of his earlier discoveries, Mr. Churchill

notes that to Nuclear Polynesia came two swarms of Polynesian migrants at periods of time separated by centuries, the Proto-Samoan and the Tongafiti. For the later swarm he indicates no course of travel before they appear in Samoa, as the data discussed in this work do not touch upon that migration. He establishes that it was the earlier, the Proto-Samoan swarm, which swept down from Indonesia along the archipelagoes of the western Pacific.

The languages of Melanesia differ widely among themselves and differ even more widely from the Polynesian. Thus the author makes it clear that the element common to the vocabularies of Melanesia and of Polynesia is loan material borrowed by the races of inferior civilization from the more alert and intelligent brown Polynesians during their sojourn in Melanesia.

In the present meagerness of records of Melanesian speech it is impossible to ascertain quantitatively the extent of such loan material now in Melanesian possession. Lacking this element, Mr. Churchill has dissected out qualitatively the use which has been made of borrowed Polynesian material. Through this inquiry he has worked out a series of percentages of borrowing, for each of the Melanesian languages for which data are available. In this wise he has established graphic curves of isology which lead to most interesting results. Instead of being a single sweep of fleets of canoes carrying the Polynesian migration through Melanesia to its destination in the unoccupied islands of Nuclear Polynesia there were two distinct migrations of Proto-Samoans, widely separated at their exit from Indonesia, distinct in the traverse of the western Pacific, never coming together until each had established itself in Nuclear Polynesia at different spots and the period began of mingling by convection in the exchange of short voyages of love and war, and above all of adventure which took place between Fiji, Samoa and Tonga.

The association of Indonesians and Polynesians, Mr. Churchill accounts for by the same explanation of loan material. Since the languages are of different types it is impossible to conceive of their consociation in a single speech family.

He does not undertake to identify the early home of the Polynesian race west of Sumatra, for at that point the linguistic data cease to exist for philologic study.

THE MEASUREMENT OF THE INTENSITY OF GRAVITY ON THE OCEAN AND ITS SIGNIFICANCE

BY

G. W. LITTLEHALES

Considering the degree of advancement that has long since been reached in the adaptation of instrumental means to the necessities of gravitational research on the land, it was remarkable that, up to the beginning of the Twentieth century, no beginning had been made in gathering observations to reveal a knowledge of the intensity of gravity over the oceanic areas. The unsteadiness of the observing platform and the consequent effect upon the inertia of masses, even under exceptional circumstances of calm at sea, are such as to preclude the application of methods depending upon the measurement of the time of flight of a plummet, or the oscillation of a pendulum, or, in any direct way, the changing relation, with change of locality, between a given mass and its weight.

Nearly thirty years ago attempts were made to determine the variation of the intensity of gravity, from place to place, by employing a syphon barometer whose short arm was closed, and contained a certain quantity of gas. At a given temperature this gas had a certain volume and exerted a certain pressure to contribute toward balancing the mercurial column; the greater the intensity of gravity, the greater would be the relative heaviness of the mercury and the shorter would be the barometric height corresponding to the pressure. The required exactness could not be attained either on the land or on the sea by this method because of the insuperable difficulties that arose in ascertaining proper corrections for temperature; and it was not until Dr. O. Hecker, using the method suggested by Mohn of Christiania, made elaborate experimental measurements,* under the auspices of the International Geodetic Bureau, on board the steamer Petropolis, of the Hamburg-South American Line, between Europe and Brazil, in the summer of 1901, that the first actual measures of the intensity of gravity over an oceanic basin were determined.

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* "Bestimmung der Schwerkraft auf dem Atlantischen Ozean sowie in Rio de Janeiro, Lissabon, und Madrid," von O. Hecker, Königl. Preussischen Geodatischen Institutes, neue folge, No. 11, Verlag von P. Stankiewicz, Berlin, 1903.

The operation consisted of employing, side by side, a boiling-point apparatus and a mercurial barometer, and comparing the true pressure of the atmosphere as indicated by the temperature of unconfined steam with the pressure indicated by the height of the barometric column.

In the mercurial barometer a mass of mercury is made to mount to a certain height in balancing the pressure of the atmosphere; and this height is greater or less, for the same absolute pressure of the atmosphere, according to the weight of the mass of mercury in the barometric column. And since the weight of a given mass of matter is dependent upon gravity, a definite relation must exist, at any given place, between the height of the mercurial barometer and the boiling-point of water. This relation is altered on going to another place where the intensity of gravity is different, and hence the comparison of the readings of the mercurial barometer and the boiling-point thermometer affords the means of determining the variation of the intensity of gravity from place to place.

The practical applicability of the method depends upon the exactness with which the instrumental readings can be observed on board a ship at sea. With a good barometer, the barometric reading can be obtained to within an amount ranging from one-fiftieth to one-twentieth of a millimeter. To obtain with the hysometer an exactness corresponding to that with which the barometer can be read, the thermometer should give the boiling-point temperature to within such a fraction of a degree as corresponds to a few hundredths of a millimeter on the mercury column. At a barometric height of 760 millimeters, one-tenth of a millimeter corresponds to 0.0037 of a degree of temperature, or one one-hundredth of a millimeter to 0.00037 of a degree; and at a barometric height of 650 millimeters, one-tenth of a millimeter corresponds to 0.005 of a degree of temperature and one one-hundredth of a millimeter to 0.0005 of a degree. Hence to obtain the true atmospheric pressure to within one-twentieth of a millimeter, the boiling-point thermometer should give the temperature to within 0.002 of a degree.

In spite of the refinements demanded and of the necessity for eliminating the effects of the movements of the observing platform upon the barometric column, memorable results* have been attained in voyages traversing the Pacific and Indian oceans as well as the Atlantic, which exercise a broad influence in geography.

* "Bestimmung der Schwerkraft auf dem Indischen und Grossen Ozean und an deren Küsten," von O. Hecker, Zentralbureau der Internationalen Erdmessung, neue folge No. 16, Georg Reimer, Berlin, 1908.

Before this achievement, knowledge in relation to the intensity of gravity and its variations on the globe was confined to the land masses; and geodesists, taking together the available measurements of the intensity of the gravity resulting from pendulum experiments in various parts of the world and the observed deflections of the vertical disclosed by the comparison of geodetic triangulation with astronomical observations, had deduced a theoretical expression for the normal value of gravity at sea level according to which its intensity was represented as increasing from the equator to the poles by increments proportional to the square of the sine of the latitude and the square of the sine of twice the latitude jointly. Standard gravity was defined as the intensity of gravity in latitude 45° at sea level, and meteorologists had adopted the custom of reducing barometer readings made both on the land and on the ocean to standard gravity as computed from this theoretical expression. It was therefore a matter of import to meteorology that it should be ascertained, by observation and measurement, whether the theoretical variation of the intensity of gravity with latitude actually applied to the oceanic as well as to the continental areas. The general results of the relative determinations that have been made at sea is to establish the fact that gravity is normal over the surface of the ocean. Locally, as in the vicinity of the Tonga Islands, there are irregularities; and there is a highly interesting variation in intensity in passing outward from a continent to the deep sea, according to which the intensity is in excess in the shallow coastal waters, in defect at the beginning of the deep sea, and thence of normal value.

Moreover, studies of pendulum and geodetic observations had also given rise, during the last century, to theories respecting the distribution of matter inside of the earth, and these could not be confirmed or extended until the intensity of gravity over the oceanic areas was made known. Exact triangulation and surveying had revealed a relation between the deflections of the plumb line and the plateaus, mountains, and valleys constituting the visible irregularities of the earth's surface; but computations had shown that the deflections of the vertical which must be produced by the attraction of these visible irregularities of the earth's surface are much greater than those which are observed, and that beneath the crust of the earth there must be such a distribution of the densities of materials as will bring about an incomplete balancing of the effects of the visible topography upon the direction of the plumb line. The recog-

nition of this relation between the sub-surface densities and the surface irregularities of the earth was the foundation of the doctrine of isostacy, which postulates that above a certain depth, at which the pressures in the interior of the earth are equal in all directions as in a perfect fluid, there will be in every vertical-sided, inverted, truncated pyramid, of equal cross section, reaching to the surface of the earth, the same amount of matter. Thus, if it be true, as geodesists have computed,* that the depth of compensation is 114 kilometers below the sea level, any column extending down to this depth below sea level, and having one square kilometer for its base, has the same mass as any other such column. One such column, located under a mountainous region, may be 3 kilometers longer than another located under the sea coast. On the other hand, the solid portion of such a column under one of the deep parts of the ocean may be 5 kilometers shorter than the column at the coast. Yet, according to the doctrine of isostacy, each of these three columns will contain the same quantity of matter. The masses being equal and the lengths of the columns different, it follows that the mean density of the column beneath the mountainous region is 3 parts in 114 less than the mean density of the column under the sea coast. So, also, if the intensity of gravity is normal over the surface of the ocean, the mean density of the solid portion of the sub-oceanic column would have to be in excess of the mean density of the seacoast column by an amount somewhat less than 5 parts in 114, seeing that the water of the ocean virtually constitutes a part of the column.

Inasmuch as actual measurements have shown that the intensity of gravity is normal over the Atlantic, Pacific, and Indian oceans, the theory of isostacy is validated, for not only must the superficial masses of continents be compensated by a defect of density in the earth's crust beneath them, but the lightness of the ocean must also be compensated by an excess of density under the ocean bed.

To be able to say that, through a thickness of 70 miles, the mean density of the earth's crust is 7 per cent. greater under the floor of the ocean than under the continents is to limit the range of controversial subjects connected with terrestrial physics.

Concerning the dispute as to whether the oceans have always had

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* "The Figure of the Earth and Isostacy from Measurements in the United States," by John F. Hayford, Inspector of Geodetic Work, and Chief, Computing Division, Coast and Geodetic Survey. Department of Commerce and Labor, Coast and Geodetic Survey, Washington, Government Printing Office, 1909.

the same general extent and positions since the waters were gathered together or as to whether, by alternate rising and sinking of the earth's crust, oceans and continents have successively occupied the same areas, the deciding stroke appears to have been delivered in favor of the permanence of ocean basins, on account of the extreme improbability that there could be such a shifting of materials in the depths of the earth's crust as would cause the sub-oceanic heaviness to give place to the sub-continental lightness which has been found to subsist.

Henceforth, more definiteness of thought may, therefore, characterize the treatment of the train of geographical questions which depend upon the delimitation and the circulation of the oceans, and their effect upon evolutionary processes.

A NEW MAP OF ARABIA

A map of Arabia on a scale of 32 miles to an inch is at present under publication in India. The compilation, from all available sources of information, is by Captain F. Fraser Hunter, Indian Army, of the Survey of India, and is the result of some years of diligent research.

The projection is the same as that adopted by the Survey of India for the 32-mile-to-the-inch map of India—*i. e.,* the modified secant-conical, a feature of which is that there is no central meridian. This projection enables the map of Arabia to be fitted alongside the map of India, thus giving, at a glance, a map of that portion of the world between Burma and Egypt. It should be possible, later, to produce other such maps to include China and Africa.

Captain Hunter's map of Arabia is the first and only one compiled on so large a scale, and it should shed much light on hitherto obscure points in the geography of that region and be a stimulus to more exact inquiry in the future.

The main points of interest in this new map are: Charles Huber's notes have been recompiled and all his astronomical observations worked out and corrected. His barometric readings have been reduced to their correct value by comparison with sea-level readings, taken, at the same instants, at the Survey of India tidal stations at Bombay, Bushehr and Aden (Loomis's Formula).

The map sheds much light on the various routes, pilgrim and otherwise, across Arabia, gives a new and definite theory as to the great Tuwaiq Range and the Wadi Dawasir system, assigns a new position to the much-disputed Jabrin oasis, and leaves little to be conjectured as to the whole Persian Gulf littoral and much of its hinterland. The topography of the Oman peninsula has been more definitely depicted, conflicting authorities as to the geography of the Hadhramaut have been reconciled, and much new data on that region utilized. Of the southwest corner of Arabia, from the large geographical point of view, it leaves nothing now to be ascertained. At the same time, all former and new information as to Yaman has been added to the work of Herr Glaser. The Hijaz Railway is shown completely.

These are a few of the many points entered into by this new map. But the chief lesson it brings home to geographers is that, by the very largeness of its scale as compared with other maps, it shows what an immense stretch of the unknown still lies in Arabia.

The system of transliteration is that recently adopted by the Government of India.

It is understood that an effort is to be made to include in this map, before final publication, the routes of Captains Butler and Aylmer and of Mr. Douglas Carruthers. The data from these two expeditions were not available when this map was completed.

GEOGRAPHICAL RECORD

NORTH AMERICA

CARL LUMHOLTZ'S EXPLORATIONS. The Society has received a letter from Mr. Lumholtz, written at Sonoyta, in the Northwest part of Sonora, Mexico. on April 4. He left New York in May, last year, to make ethnological and physico-geographical investigations in the arid northwestern part of Sonora (*Bull.* 1909, p. 383). He writes that he has been at work there for many months and has also included in his field the adjacent southwestern part of Arizona. Sonoyta is an oasis in the arid region and he had just returned there from a three months' journey in the desert proper, travelling west to the Colorado river, south to the Gulf of California and north to the southern Sierras of Arizona. The region is very little known. Drs. Hornaday and Macdougal, in their journey, about two years ago, went only a short distance to the west and south of the Pinacate Mountains.

Mr. Lumholtz travelled entirely around the Pinacate region which extends about 50 miles, north and south. He also spent several days at Sierra Blanca,

south of it, a hitherto unexplored mountain range. In the arboreal desert west of Pinacate, there are comparatively few Sierras or Cerros but he visited several that were unexplored and nameless. One mountain, which he named El Capitan, southwest of Sierra de la Tinaja Alta, will be a landmark for travellers who must pass it to reach Laguna Prieta, an interesting lake on the border of great sand dunes. Its waters are salt but potable water is found by digging among the bullrushes on its marshy shore. When he reached the lake his animals had been 76 hours without water.

From the Colorado river he travelled south along the coast, using water, more or less brackish, for 20 days. A spade is needed in the outfit to dig for water at some places known to the Indians and a few Mexicans. At one place drinkable water was found on the beach, covered at high tide but oozing between some rocks at low tide. Grass for the animals was not abundant, but there are several kinds, the most important being the *galleta*. A number of bushes, especially the *chamiso,* supply good fodder; but the leaves of the ironwood tree are best relished by horses, mules and donkeys. As a rule, his animals had water only once in 36 hours. Sometimes they were 72 hours without it. The mules and donkeys stood this well when the weather was not very warm, but most of the horses died in the sand dunes though born in these western regions. Donkeys are best adapted for this kind of exploration, and mules next.

While at a water hole in the Pinacate region, Mr. Lumholtz, with two Indians, made a 13-days' trip to explore a Sierra which is visible both from Pinacate and the Colorado river. They found only two water places, so-called tinajas (natural tanks), where rain water collects. They travelled 175 miles and returned to camp with their burros (donkeys) in good condition. One of them carried two barrels of water, about 200 pounds. Mr. Lumholtz continues:

"The tinajas are drying up for there has been no rain this winter, excepting a little in January, in the extreme western part of the desert. Still the vegetation, such as it is, seems to thrive. The curious, straggling *ocotillos* show their splendid red flowers that look so well against the gray and somber background of the Sierras. In the sand beds of the arroyas, dry since last September, grow *chuparosa* higher than a man, covered with hundreds of flowers. The brittle bush near it is covered with yellow flowers and both suggest tropical luxuriance. These plants must have their roots very deep in the sand.

"The desert is usually silent, to be sure, but has its animal life. Quails are found up to 20 miles from water; also the mocking bird and several other songsters. Hawks and buzzards are found everywhere. Lizzards, mice and rats abound. The mountain sheep is numerous among all the Sierras from the Colorado and Gila rivers almost as far as Hermosillo, the Capital of Sonora. Jack rabbits and cotton tails are seen but are not numerous. These animals, apparently do not need much water. The Indians say that the animals of the desert never drink, unless it rains. The antelope is fond of eating the spring *cholla,* which contains a great deal of water; hence its abstinence from water may be understood. Mexican cattle are known to subsist for weeks and months on the green and juicy herbs of the sand dunes, after the winter rains, as well as on the *cholla,* without needing to drink water, and they grow fat by it. This, I might verify by many interesting facts.

"The country explored by me is a great arboreal desert, with numerous Sierras, much worn down. They run almost invariably from southeast to north-

west and, oddly enough, this is generally also the direction of the veins of ore here. The formation is granite and volcanic.

"Across this arboreal desert, in its southern part, runs a belt of sand dunes, from Puerto de Lobos, in the neighborhood of Caborca, almost to the Colorado river. It is generally close to the sea, but gradually retires somewhat from the coast. At Laguna Prieta, it is nearly 20 miles away. This belt of sand dunes is interrupted for some miles at Sierra Pinto. The largest sand dunes are found in the western part of the belt. I measured one by my aneroid and found it to be 185 feet high; others may be slightly higher. The sand dunes are of a somewhat reddish hue and there is nothing depressing about them.

"I shall have a later opportunity to describe their peculiar animal and plant life. As for those interesting natives of the desert, the Papago Indians, I shall also have to defer to the near future, any mention of them."

IMPOVERISHING THE SOIL. The great grain regions of Central Canada are producing larger crops of wheat every year, but this is because the acreage sown to wheat is rapidly increasing and not for the reason that anything is yet being done to maintain the fertility of the soil. The statistics in "Canada West," one of the recent publications of the Department of the Interior, Canada, show that the average yield, per acre, in Manitoba was 26 bushels in 1902, 14.22 bushels in 1907, and 17.28 in 1908; Saskatchewan, 25.41 bushels in 1901, 14.9 in 1907 and 13.60 in 1908; Alberta, 24.58 bushels in 1901, 22.13 in 1907 and 22.60 in 1908. In fact, the pioneer farmers of that great, new source of wheat supply are following the same system of incessant cropping of the land that has reduced the average production in our own great wheat states to 13.5 bushels per acre while in England it is 30 bushels, in Belgium, 34.5 bushels and in Germany, 27 bushels. The needs of the world, of course, will ultimately require that these exceptionally fine wheat lands be won back to their early fertility by scientific tillage.

SURVEY OF THE NORTHERN AND NORTHWESTERN LAKES. The U. S. Lakes Survey Office, Detroit, Mich., has issued *Bulletin* 19, giving a description of the Great Lakes, their harbors, channels, and navigable tributaries, with a large amount of detail of special use to mariners. This publication is issued annually, No. 19 being current during the present year, while supplements are issued monthly during the navigable season to supply all items of change affecting the published matter of the Bulletins. Thus the Bulletins and Supplements together supply the detailed descriptions and the particulars of constantly changing conditions that cannot be shown on the charts. These publications are supplied free of charge to navigators and other chart purchasers.

SOUTH AMERICA

IRON RESOURCES OF BRAZIL. The Geological Survey of Brazil has prepared a report on the available iron-ore supply of the country for the International Geological Congress which meets at Stockholm this year. Attention is called to the enormous wealth of the State in this respect. It is stated that when the full text of the report is published it will startle the iron world and be the sensation of the congress. On the basis of the examination of fifty-two localities in Minas Geraes it is reported that the ore is from 60 to 75 per cent. pure iron and free from all impurities that would interfere with its proper smelting. The total amount of easily accessible high-grade ore in the state of Minas Geraes alone is

conservatively estimated at 12,000,000,000 tons. In addition, high-grade ores are found in seven other states and iron ores of good appearance are known in every state in the country. The ores of Minas Geraes, São Paulo, Bahia, and Matto Grosso are predominatingly hematites, the others chiefly magnetites. The ores of Minas Geraes occur in one of the oldest and most densely populated interior regions of the country and on the road to the diamond mines of the northern part of the state, though about 500 kilometers from the coast. It is proposed to carry a railway line from the ore fields to the excellent port of Victoria and so improve the facilities for handling the ore that this port will become the center of the export industry. The iron ores occur in beds of quartzite and clay slates with subordinate beds of limestone, the whole series resting upon a complex of crystalline schists and gneisses intruded with granite. The massive portions of the iron-ore beds stand out as conspicuous topographic features, because of superior hardness, in the form of ridges heavily cloaked with ore rubble. Without coal deposits of comparable extent, Brazil can not hope to become a leader in the iron world unless other sources of power be developed or new sources discovered. The relative nearness of the deposits to the sea and the low rate of ocean transportation may offset this disadvantage however and make it possible for Brazil to supply the industrial countries of the northern hemisphere with cheap iron-ore when their deposits have become extensively depleted. ISAIAH BOWMAN.

PROF. BREWSTER'S LECTURE. On Feb. 15, Professor James H. Brewster, of the University of Michigan, gave a lecture before the Society on certain phases of life in South America under the title "From Bahia to Buenos Aires." Mr. Brewster emphasized the remarkable diversity of conditions in the southern continent, gave a summary of the causes of this diversity, and showed that what is first needed for a correct understanding of our southern neighbors is to avoid forming too general a conception concerning them.

The superior illustrations, 100 in number, which accompanied the lecture, well exemplified this diversity. Views of São Salvador da Bahia, the old colonial capital of Brazil, were contrasted with a few scenes from the old Inca capital, Cuzco, in the same latitude. The characteristic features of Rio de Janeiro, Petropolis, and São Paulo were illustrated, as well as those of Montevideo, Buenos Aires and its neighbor, La Plata.

ASIA

THE STUDY OF TROPICAL FORESTS. Prof. J. Paul Goode writes to the *Bulletin* from Chicago that a private letter from Manila, announces the publication of Dr. H. N. Whitford's work on "The Composition and Volume of the Dipterocarp Forests of the Philippine Islands." It is issued by the Forestry Bureau of the Philippine Islands and represents several years of field work by its author. The magnitude and financial value of these forests are strikingly shown by a single quotation: "Our virgin forest area comprises 25,000,000 acres and has 200 billion board feet of timber standing on it. This is a good showing when compared with the 400 billion feet of timber on the 200,000,000 acres of the United States Forest Reserves."

Dr. Whitford is now at work on a larger and more complete monograph on "The Forests and Principal Forest Trees of the Philippines." The success of

the work done by our forestry service in the Philippines has won the admiration of all the governments interested in tropical forests. Dr. Treub, former director of the Botanical Gardens of Java, has sent a man to Manila to study the American forestry methods. An official of Portuguese East Africa has written asking Major Ahern, Director of Forestry, if he can send two experts to organize a similar survey for the African forests. Mayor Ahern in reply, gives some facts that will be of interest to Americans in general:

"The Bureau of Forestry has had the difficult task of investigating, protecting, and developing the enormous forest areas of the islands, without adequate men and funds for carrying on the work. In spite of these difficulties, however, most of the forests have been classified, estimated and mapped, and we now know what the forests of the Philippines contain, where and how the different forest types are situated, and the approximate cost of placing their lumber on the market.

"The forest wealth of the Philippines is found most largely, not in the high-priced cabinet woods, although their value is very large, but chiefly in the stands of cheaper structural timbers, such as may be used for most purposes in place of Oregon pine and Baltic fir and other similar timbers in Europe and America. This is distinctly advantageous, although it is contrary to the general idea of the composition of tropical forests. The value of the timber is further increased by the fact that the structural species often occur in almost pure stands and in large quantities, making their logging by modern steam methods comparatively simple and economical.

"I believe that the structural possibilities of tropical forests have been decidedly underrated, and that an investigation of other countries besides the Philippines will show large bodies of timber that can be lumbered cheaply and used for general construction purposes, for which there is always a large and steady demand."

Major Ahern adds: "Of all the men who, under my direction, have had charge of the forest work in the Philippines, chief credit is due to two foresters for what has been accomplished. These are Dr. H. N. Whitford, Chief of the Division of Investigation in this Bureau, and Mr. H. M. Curran, Forester in the same division."

These two men have an ambition to explore and take an inventory of tropical forests in general, the world around, and are hoping to obtain financial aid from the various countries interested, and possibly from private sources, and to organize extensively for the work.

Dr. Whitford is convinced that the "value of the tropical forests as a world asset is not appreciated, simply because our knowledge concerning their possibilities is so limited." He believes it is possible to open up to the world's commerce, immense wealth in tropical timber.

AUSTRALASIA

Surveys in Western Australia. The Report of Surveyor General Johnston, for the year ending June 30, 1909, shows that the Department of Lands and Surveys is making diligent study of the economic resources of the State other than mineral wealth, which, in earlier years, has absorbed the largest share of attention. Several parties, in the past fiscal year, have been engaged in the

coastal country between Manjimup and Denmark, determining the extent of valuable forests and of lands with little marketable timber that are worth throwing open to settlement. It appears to be the policy to keep the best timbered lands out of the market in order to conserve the supply. Some of the survey parties report important areas that are suitable for cultivation and also great stretches of plains with sandy subsoil that, in places, are covered with a sufficient depth of mould to justify the belief that they may be turned into useful grass lands. The year's work resulted in a large number of maps and plans.

POLAR

PEARY'S SOUNDINGS FROM CAPE COLUMBIA TO THE POLE. On March 22 last, the Hon. J. Hampton Moore, of Pennsylvania, spoke in the House of Representatives, Washington, on Commander Peary's discovery of the North Pole. He gave considerable hitherto unpublished information, the most important relating to the soundings that were taken on the ice journey between Cape Columbia and the Pole. The following data are from Mr. Moore's speech which was printed in full at the government printing office. Here is the table of soundings:

SOUNDING BY	LATITUDE.	FATHOMS.	REMARKS.
	83° 7′	0	
Marvin	83° 10′	98	Edge of glacial fringe.
Marvin and McMillan	83° 25′	96	
Bartlett	83° 53′	110	Edge of continental shelf.
Marvin	84° 29′	825	
"	84° 39′	580	
"	85° 23′	310	
"	85° 33′	700	No bottom.
Bartlett	87° 15′	1,260	" "
Peary	89° 55′	1,500	" "

In Commander Peary's notes he says that the sounding equipment consisted of two reels of specially made piano wire of 1,000 fathoms each, and three 20-pound leads with clam shell device for grasping samples of the bottom. One of the reels and leads was carried by Bartlett with his advance party and the main party carried the other reel and two leads. Portions of the main party's wire and the two leads were lost at various times, in hauling up, probably on account of kinks in the wire. When the main party sounding of 700 fathoms, no bottom, was made, this was all the wire they had left. When Bartlett ran out 1,260 fathoms, he stopped on account of a kink in the wire which he feared would part when the wire was hauled up. At this time, his 1,000 fathoms of wire and the remaining 500 fathoms of the other reel had been combined. Peary took this combined wire and made his sounding with it near the Pole, 1,500 fathoms, no bottom, and was hauling up when the wire parted again and he lost nearly all of it and the last lead. These facts explain the irregularity of the soundings that did not get bottom. Commander Peary adds these comments:

"The sounding of 310 fathoms at 85° 23′ naturally impressed me at once as surprising and when Marvin reported the result to me, immediately after taking the sounding, I at once asked him if he was sure that he had the bottom, and he replied that he was, as the fact of this pronounced shoaling from 825 fathoms to 310 impressed him at once, and he made sure that his depth was correct.

"Again, when the sounding of 700 fathoms and no bottom was made about

10 miles further north, we both spoke of the peculiar fact of this outlying ridge with deeper channel intervening between it and the continental shelf, and Marvin again said that he was sure of his 310 fathoms reading.

"Had it not been for the loss of the last lead and practically all of the wire while making the soundings at the Pole, I should, on the return, have interpolated other soundings.

"The profile indicates that a line of 5-mile interval soundings from Cape Columbia to the eighty-sixth parallel might develop a particularly interesting profile of the bottom of the Arctic Ocean."

Mr. R. A. Harris, the tidal expert of the Coast and Geodetic Survey, reported on Peary's tidal records which consisted of practically unbroken series of hourly readings of the height of the tide, taken night and day, at Cape Sheridan for 231 days, Cape Columbia, 29 days, Cape Bryant, 28 days, and Fort Conger, 10 days. Mr. Harris says that, in order to show the full geographical value of the results, they must be considered in connection with all other Arctic tidal results. This work is now in progress. Peary's tidal observations leave little to be desired between Cape Morris Jesup and Cape Columbia; but there are long stretches of the Arctic coast where nothing is available. This is especially true of the Russian coast and the western and northern portions of the Arctic archipelago. Peary's results show that the tides along the northern coasts of Grantland and Greenland differ in many respects from what had been supposed. For example, his records prove that the tide occurs three hours earlier at Cape Columbia than at Cape Sheridan, and not later, as had been assumed.

PHYSICAL GEOGRAPHY

Landslides. In a recent study of landslides (Landslides in the San Juan Mountains, Colorado, by Ernest Howe, *Prof. Paper* 67, U. S. Geol. Surv., 1909, pp. 1-55), Mr. Howe describes the Cimarron landslide of 1886 and two other recent landslides. The older groups of landslides of the Telluride, Rico, Silverton, and three other districts are presented, together with one slip which seems to be interglacial. The classification and explanations of landslides by Heim and by Penck are summarized. The landslides of the San Juan Mountains are then discussed in relation to shattering, jointing, relation of weak and resistent layers and other physical conditions which vary considerably in the sedimentary and the volcanic rocks of the landslide areas. These factors have had a stronger influence on landslides than structural conditions. Topographic conditions, especially the oversteepening of valley walls through glacial erosion, have had an important relation to the landslides, as have certain external causes, such as earthquakes, readjustment of internal stresses in the mountains, and saturation of the rocks by meteoric waters. A classification of the hundred or more San Juan landslides is presented.

A specialized type of landslides, the rock streams, are discussed by Howe, Patton, and Capps. The first descriptions are in the above publication (pp. 31-41, 49-55), where Mr. Howe describes a number of these forms. They seem to be intermediate between ordinary talus and landslides and look like small glaciers completely covered with ablation moraine. One of these streams is three-fourths of a mile long, one-fourth of a mile wide and 50 to 100 feet deep. An adjacent mud flow is over six miles long. The streams are illustrated by

excellent photographs and maps. They are classified as due to rock falls, in contrast to rock slides which result in landslides. In the case of the rock streams it is conceived that the rocks are shattered, and if the mass is of sufficient magnitude, the shattered rock may move outward from the base of the cliffs with great velocity as a flow of newly-made detritus.

Prof. H. B. Patton describes a second group of rock streams, also from Colorado (Winter meeting, Geol. Society of America, Dec., 1909). They are on the west side of Veta Mountain, east of the Sangre de Christo Range.

The third series of rock streams are in Alaska (Rock Glaciers in Alaska, by Stephen R. Capps, Geol. Soc. of Washington, *Science,* N. S., Vol. XXX, 1909, page 974). Mr. Capps describes a series of rock streams, also shown finely on the Nizina Special map of the U. S. Geological Survey. They are from one-half mile to two and one-half miles long, from one-tenth to three-fifths of a mile wide and have slopes varying from 9° to 18°. "In slopes, shape, and surface markings they bear a striking resemblance to glaciers. In the upper portions, longitudinal ridges and furrows are conspicuous, while toward the lower ends the ridges become concentric, parallel with the borders of the lower ends of the flows. A few of the rock glaciers actually grade into true glaciers at their upper ends." All these rock glaciers are said by Mr. Capps to be cemented with interstitial ice which has imparted their motion to them. Why they are not dying glaciers is not stated.

These Alaskan rock streams or rock glaciers head in cirques which no longer have perennial snows, although adjacent higher cirques produce many glaciers in the same region. This raises the question whether the Colorado rock streams, described by Messrs. Howe and Patton, some of which, at least, head in cirques and which except for the observed interstitial ice seem exactly like the Alaskan masses, may not have been formed in association with the former glaciers of Colorado.

LAWRENCE MARTIN.

A NATIONAL BUREAU OF SEISMOLOGY. The following resolution was passed by the Seismological Society of America at a meeting held in San Francisco, on March 2:

"*Resolved,* that the Seismological Society of America strongly favors the establishment of a National Bureau of Seismology with power: (*a*) To collect seismological data; (*b*) to establish observing stations; (*c*) to study and investigate special earthquake regions within the national domain; (*d*) to co-operate with other scientific bodies and organizations and individual scientists in forwarding the development and disseminaton of seismological knowledge.

"It also favors the organization of this bureau under the Smithsonian Institution with the active co-operation of other scientific departments of the government."

Copies of the resolution were sent to the President, President of the Senate, the Speaker of the House of Representatives, Secretary of the Smithsonian Institution and the members of the House Committee on Library which has this matter under consideration.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Die Polarforschung, ihre Ziele und Ergebnisse. Von Eugen Oberhummer. 53 pp. Vorträge des Ver. zur Verbreitung naturwissens. Kenntnisse in Wien, Vol. 48, Heft 17, Wien, 1908.

A lecture by the Professor of Geography in the University of Vienna, giving a summary of polar endeavor, its purposes and results. Dr. Oberhummer, writing before the attainment of the North Pole, said he had no doubt that this event was approaching; and when the Pole was reached, the value of the achievement would not appear very important and systematic and scientific exploration would again take the foreground.

The United States, with Excursions to Mexico, Cuba, Porto Rico and Alaska. Handbook for Travellers by Karl Baedeker. Fourth Revised Edition. cii and 724 pp., 33 Maps, 48 Plans and Index. Karl Baedeker, Leipzig; Charles Scribner's Sons, New York, 1909. M. 15.

It was a peculiarly difficult task to write a first rate guide book of a country so vast and so rapidly changing as the United States. From the first, however, Baedeker's United States was a great success and the succeeding editions have kept it up to date. The effort to make this book comparable with those in the same series on the countries of Europe was an arduous task and the publisher is to be congratulated on the success attained. The work appeals not only to the foreign but also to the American traveller and in the present edition more emphasis is given, than in the earlier issues, to many places that are interesting from their association with American history and literature. Praises for Baedeker are much like commendation of the alphabet but it may, at least, be said that we have no publication in our country that fills the place of this Handbook; and we shall be glad if, in a generation or two, we may be able to fill any American book in the general trade, with such superior and efficient maps as are to be found in this volume.

Geographisches Handbuch. Allgemeine Erdkunde, Länderkunde und Wirtschaftsgeographie. Unter Mitarbeit hervorragender Fachmänner, herausgegeben von Albert Scobel. Fünfte neubearbeitete und vermehrte Auflage. In zwei Bänden. Erster Band—Allgemeine Erdkunde, Länder-und Staatenkunde von Europa. xvi and 957 pp., 522 Illustrations and maps in

the text, 7 black and 5 colored plates and a colored map; Zweiter Band—Länder and Staatenkunde der aussereuropäischen Gebiete. Wirtschaftsgeographie. xiv and 816 pp., 204 Illustrations and Maps in text, 7 black and 7 colored Plates, Bibliography and Index. Velhagen & Klasing, Leipzig, 1909. M. 20.

Every issue of this standard Handbook has been awaited with interest, because, on the whole, it is the best work of the sort that is published. The five editions form, in themselves, a good summary of geography. The present issue is the first in two volumes and contains fully three times as much matter as any of the earlier editions. The editor had the collaboration of fifteen of the leading geographers of Germany, all men of international reputation, as Penck, Krümmel, Drude Meinardus, Rein and Sapper. This work, appearing every few years, with its hundreds of maps and diagrams and its authoritative letterpress, keeps nearly every phase of geography up to date, dealing not only with the descriptive side of the study but also with most other geographical aspects. It is perhaps noteworthy, and a little curious, that Prof. Scobel, the able editor of all the issues of this work and the Director of the map house of Velhagen & Klasing, does not provide an occasional article on cartography.

The work especially appeals to teachers, students, merchants and intelligent persons, who read German, as a guide and reference book in geography.

Miguel Triana. Por el sur de Colombia. Excursión pintoresca y científica al Putumayo. Prológo de S. Pérez Triana. xxiii and 355 pp., Map and Index. Garnier Hermanos, Paris (1908).

The author is a Colombian civil engineer, who went inland from Tumaco, one of the Pacific ports of Colombia, to search for routes that might be made practicable wagon roads between the highlands of the Andes, at Pastro, and navigable tributaries of the Amazon. A little steamer took him as far inland as Barbacoas on the Telembi R. His journey thence was along the wretched path which laden mules have travelled, for generations, to Pasto. His real work began at this point, whence a short journey to the southeast took him to La Cocha, a large lake, 9,000 feet above the sea, from which issues the Guaimés branch of the Putumayo tributary of the Amazon.

He descended this branch, to its junction with the Putumayo, making the journey in a canoe, in spite of rapids and other obstructions. The Putumayo itself is very well known, for the present President of Colombia descended it in 1874, about 1,000 miles, to its mouth; and Dr. Crevaux in 1878-9, ascended the river for 800 miles to Cuemby, in a steamer, and reported it navigable to that point for vessels drawing 6 feet. It is believed to be better adapted for navigation than most of the Amazon tributaries.

Having reached this known river, the explorer turned north and ascended the Guineo affluent of the Putumayo and then crossing a divide, paddled up the Mocoa affluent of the Caquetá or Yapura, another of the great Amazon tributaries. He thus examined three water approaches to great rivers leading to the Amazon. He seems to have proven that it will be a difficult and very expensive undertaking to connect this part of the Andean plateau with good navigation leading to the Amazon. His book is delightful reading, for it is not merely a scientific record but graphically describes a very little known part of southern Colombia.

Henry Hudson. A brief Statement of his Aims and his Achievements. By Thomas A. Janvier. To which is added a Newly-Discovered partial Record now first Published, of the Trial of the Mutineers by whom He and Others were Abandoned to their Death. 148 pp. and Illustrations. Harper & Brothers. New York, 1909. 75c.

This careful little volume is of the nature of a brief description of what Hudson accomplished and of the ambitions that shaped his life work. Concerning the statement that Verrazano, the Italian sailor and Gomez, the Portuguese mariner, saw the Hudson river nearly a century before Hudson discovered it, Mr. Janvier says that it is impossible to decide whether Gomez did or did not pass through the Narrows and enter the Upper Bay. "In regard to Verrazano—admitting his report to be genuine—the fact that he did pass through the Narrows into the Upper Bay is not open to dispute. He therefore must have seen—as, a little later, Gomez may have seen—the true mouth of Hudson's river, eighty-five years before Hudson, by actual exploration of it, made himself its discoverer. But Verrazano, by his own showing, came but a little way into the Upper Bay—which he called a lake—and he made no exploration of a practical sort of the harbor that he had found."

The new manuscript records of the trial of the mutineers give the sworn testimony of six eye-witnesses as to the circumstances of the abandonment of Hudson in Hudson Bay.

Mountaineering in the Land of the Midnight Sun. By Mrs. Aubrey Le Blond, President of the Lyceum Alpine Club. 71 illustrations and a map. xii and 304 pp. J. B. Lippincott Company, Philadelphia, 1908. 8vo. $3.50.

This is an extremely pleasant and entertaining book on mountain-climbing, well written, well illustrated from good photographs, and brimming with an enthusiasm that inspires the reader to follow in Mrs. Le Blond's footsteps. She has had great experience in the climbing field, at first in the Alps, but when a son of her constant guide was killed on a climb, the incident terminated her Alpine ascents and caused a search for some other desirable locality which she found in far northern Lapland. Here was discovered "all the charm of the unknown," with a summer day, 24 hours light, in which to assault a splendid series of snowy peaks. Add to this the picturesque Lapps, the innumerable lakes, the reindeer, and many other interesting features, and the picture becomes even more fascinating to the explorer. The many mountains, as yet unscaled, were all 200 miles north of the Arctic Circle and, of course, the natives declared the summits unattainable, yet Mrs. Le Blond and her guide, Joseph Imboden, who had been with her for 15 seasons in the Alps, and his remaining son, Emil, achieved many triumphs during the five summers in succession which they devoted to the conquest of this region. They made 26 first ascents. Mrs. Le Blond had no narrow escapes for, to the expert mountaineer, these happenings indicate carelessness or inexperience, and the taking of useless risks, and are, therefore, not considered at all gloryfying. The field was new; they found no paths broken by previous climbers, but marked out routes of their own. "Odd as it may seem," she remarks, "the least important duty of a guide is to know the way, while one of his first duties is to find it." "On a really hard mountain the way varies from day to day—nay even in ascending and descending." Although they were so far north,

the thermometer was often up to 85° F. in the shade, but this was no great hindrance. Indeed, few discomforts could much reduce the enjoyment of one so thoroughly appreciative of the great beauty and grandeur of the scenes amid which she toiled, and so capable of perceiving the reality of things—never mistaking petty, unpleasant trifles of the moment, for monstrous misfortunes.

"Such a view as I saw from the Kjostind my eyes had never rested on before: it alone was worth a longer journey than I had made from England." This sentence is quite typical of the whole book, the tone throughout being one of complete enjoyment. Mrs. Le Blond scorns even to try to make "record ascents" but marches to great heights for the mere love of it; and everywhere and all the time, high up or low down, she perceives a world of beauty and delight which her pen deftly and happily presents. Her senses are keen, her estimates temperate, her judgment well-balanced; in fact this book is simple, frank, sensible and instructive.

Two of the greatest dangers of Alpine climbing are absent in Lapland—the cold and the darkness—and consequently Mrs. Le Blond describes the region as the playground for guileless climbers. There is a clear, brief description of the origin and flow of glaciers, of a thunderstorm (rare above the Arctic Circle) of a practical tent for photographic purposes, and useful remarks about photographic exposures under the feeble rays of the midnight sun, as well as other observations incident to exploration of this kind. There is also a chapter on some Norwegian women, and one on the original occupants of the country, the Lapps, based on the writings of A. H. Keane. F. S. DELLENBAUGH.

Hill Towns in Italy. By Egerton R. Williams, Jr. xiv and 398 pp. With Illustrations from Photographs. Houghton Mifflin Company, Boston and New York. 8vo.

To describe without wearying repetition of phrase and detail no less than forty-three of those remarkable towns which crown the hills of Central Italy between Florence and Rome, and not only to hold the reader's attention through 400 pages but to inspire in him an eager desire to see for himself each and all, is a task of no small difficulty. Such a task well done is this work. It is a clear straight-forward account of his trip, specific enough to be of service to the traveller, and entertaining to him who must travel through books alone. Yet it is more than a traveller's tale, and ought not to be classed with many of that kind; for instead of the usual type, half personal adventure and amusing anecdote, half ill-balanced judgments of wonder and awe, we have here a sober and serious account of things as Mr. Williams found them in the Spring of 1903.

The hill towns may claim the attention of the traveller in three ways. As a geographer he may be interested in their natural setting, as an historian in their long extended and eventful history, or as an artist in their many art treasures. For the geographically minded, Mr. Williams describes with appreciation the strange situation of these towns on the hill tops, the beautiful Umbrian plain at their feet, the bleak highlands of Eturia with their characteristic ravines, and the rivers and passes of the Apennines, and he does not neglect to show how these geographical forms have conditioned the progress and decay of the towns. As his travelling was largely done in a carriage, a sense of the open road and of the oncoming of a beautiful Italian Spring pervades the account.

He is careful to recall those necessary facts of a long and momentous history which make the present remains of a town he is describing live again as in a more glorious past, a past which in many instances can be traced back of the days when Rome was young, to Etruscan times, or even, more ancient still, to Pelasgic days. The tremendous age of these city-centers of civilization, outlasting the empires which have successively governed them, is vividly impressed on the reader in the presence of some bit of ancient wall whose stones still stand as they were placed 4,000 years ago.

But to many the chief attraction of these little towns is the art treasures, more precious than many jewels, to which they form the setting and upon the presence of which they depend, now in their old age, for a livelihood. In this matter Mr. Williams has set forth his intention so well in his preface that I quote:

"It is impossible to speak of the hill towns without speaking of the works of the Renaissance that are bound into their lives. The lines of their palaces are their dress; the glowing tones of the old masters are the colors of their existence. I have tried to avoid profuseness and technicality, and to mention simply, enough of the artistic history of a place to put the reader *en rapport* with its life and appearance; and just enough of the characteristics of the chief painters and their works in the hill towns to show the difference between the Umbrian, Sienese, and Florentine schools, and to indicate the distinctive traits of the masters themselves."

Type and press-work are excellent. The map would be better with more distinct detail and with contour lines of elevation, but, as it is, enables one to follow the author in his wanderings. The thirty odd photographs illustrate so well, that one's only wish is for at least thirty more of the same excellent kind. That of S. Maria delle Pieve in Arezzo would be more useful if placed in the text descriptive of that town instead of Pienza; but errors of carelessness are few, and I have noted only the natural slip of *della* for *del Granduca* (page 221, repeated on page 224) when speaking of the Etruscan tombs near Chiusi,—Clusium it was when Lars Porsena went forth from its walls to do battle with Rome.

STEPHEN A. HURLBUT.

The Conquest of the Isthmus. The men who are Building the Panama Canal, Their Daily Lives, Perils and Adventures. By Hugh C. Weir. xiii and 238 pp., 32 Illustrations and Map. G. P. Putnam's Sons, New York, 1909. $2.

An interesting, popular, enthusiastic account of the trials and successes attending the digging of the Panama Canal. The chapters showing how the men are fed and housed, how the Zone is policed and how disease has been conquered, give intimate and impressive facts in reference to phases of the canal work that, hitherto, have been little understood in this country. Certain side issues as scorpions, tarantulas and alligators receive, perhaps, more prominence than is appropriate, for the story of the canal digging itself is thereby reduced to a minimum. In fact these phases of life on the Isthmus, which naturally attracted the interest of the writer, are so interlaced with the accounts of the actual engineering operations, that the reader feels a lack of continuity of treatment that is disappointing.

Facts are given from authoritative sources, but the statistics of progress as a whole and by month, close with August, 1908. So much has been done since

that date, and so many records for excavation have been established, that the volume does not seem sufficiently up-to-date.

Yet, if the reader will skip lightly over certain distressing descriptions of conditions in the early days, and will concentrate his attention on the more recent facts, the book will well repay reading. It is, however, not a book of reference and is popular in tone, rather than scientific. R. E. DODGE.

The Teaching of Geography. By William J. Sutherland. pp. 292 and Illustrations. Chicago, Scott, Foresman & Company, 1909. $1.25.

This is the latest addition to a phase of geography that is receiving much attention, but on which there are few inclusive contributions. The book is divided into three parts, entitled "The Nature and Scope of Geography," "The Teaching of Geography" and "Practical Suggestions." Part 1 is devoted to a discussion of certain phases of geography, with a view to bringing out the importance of an understanding of the reasons for human geographic conditions over the world. The author shows the relation of other subjects to geography and gives an excellent outline of the right point of view for the teacher, in two brief discussions of the geography of New England and of Illinois.

Part 2 discusses the necessary preparation of a teacher of geography, giving somewhat undue prominence to certain phases of physical geography, and includes a treatment of inductive and deductive lessons, together with certain other topics. The teacher who has acquired the author's point of view in reference to the scope and purpose of geography will find these outlines pertinent and helpful.

The third portion of the volume deals with the value and use of illustrative materials, of maps and models, and includes outlines for the study of weather and soils. The volume closes with an extensive—too extensive—bibliography and with a reference list for map equipment.

This outline does not give an adequate impression of the value of the volume. The author has done an important piece of work in making available for the average teacher what the better teachers have long been practicing. He has presented the value and importance of the human side of geography better than it has been presented before for teachers, in an inclusive way.

Yet the book lacks a certain strength in that it is discursive and the parts are not well knit together. Hence the thoughtful teacher will find the volume lacking in unity and incisiveness. In spite of these defects, however, the volume is a distinct addition to our literature on geography teaching, and the author deserves high praise for his success in helping elementary school teachers.

R. E. DODGE.

Robert Fulton and the "Clermont." The authoritative Story of Robert Fulton's Early Experiments, persistent Efforts and historic Achievements. Containing many of Fulton's hitherto unpublished Letters, Drawings and Pictures. By Alice Crary Sutcliffe. xv and 367 pp., 30 Illustrations. Appendix and Index. The Century Co., New York, 1909. $1.20 net.

This is an authoritative, interesting account of the life and engineering projects of Robert Fulton, culminating in a description of the famous Clermont and of its early trips on the Hudson. The writer is a great-granddaughter of the inventor. The volume contains many reproductions of pictures of people associated with Fulton, of Fulton himself, and of his various studies for steamboats.

The author has drawn on many sources for materials, not hitherto available, and has presented a volume that is timely and valuable. An appendix contains many reproductions of interesting letters from Fulton or in reference to his works, and a list of his paintings. R. E. DODGE.

Die Wanderungen der Polynesier nach dem Zeugnis ihrer Sprachen. Von Franz Nikolaus Finck. 4 chart diagrams. *Nachrichten* von der Königlichen Gesellschaft der Wissenschaften zu Göttingen, philologisch-historische Klasse, Heft 3, 1909.

The title would be more accurately stated as the secondary migrations of the Polynesians, for Prof. Finck deals entirely, save for one important exception, with the swarming of the Polynesian peoples from Samoa to the onward archipelagoes of the South Sea. For any such inquiry the material exists in two forms. The more obvious lies in the historical record preserved in the vast volume of tradition existing in every one of the eastward groups. The second is in the material remains preserved in the speech, fossils which yield to the research of the philological inquirer. For his inquiry both sources of information lay ready to hand. That he has wholly disregarded the former has deprived him of a series of valuable counterchecks which might have spared him several errors.

A central error vitiates his conclusions. A closer dissection of the languages of Nuclear Polynesia should have revealed to him the fact that the Polynesian tongue there exists in two widely separated stages of phonetic development. A brief review of Samoan traditions would have shown him that these phases of language mark the contours of two separate swarms of migration to Nuclear Polynesia, the elder denominated in my system the Proto-Samoan, the junior the Tongafiti. These traditions list the tale of the generations which elapsed between the Proto-Samoan occupation of Nuclear Polynesia and the coming of the Tongafiti swarm, and the generations are readily reducible to a round number of several centuries. This lapse of time, thus distinctly recorded, is equally manifest in the modification of the speech.

Neglecting this duality of the migration to Nuclear Polynesia, Prof. Finck is led into error by regarding the eastward migration out of Nuclear Polynesia as practically homogeneous. He finds only the later, the Tongafiti migration, and not all of that. Yet in my recent studies of the subject I have been able to establish distinctly a Proto-Samoan migration directly from Nuclear Polynesia to Hawaii on the north, to New Zealand on the south, and eastward to Tahiti and Mangareva, all upon a purely philological base and none discoverable in his method. The key is the fact of the two migrations separated by many centuries, and this key seems not to have been within his reach.

Of the primary migration, the courses of the two streams into Nuclear Polynesia, he has little to say. He proposes for the immediate approach to Samoa a voyage from Vaitupu, thence to Fakaofo, thence to Samoa. Yet the peopling of Fakaofo and Vaitupu is very modern, the languages represent almost the current stage of Samoan and the traditions make it very clear that wanderers from Samoa, in most modern centuries, provided the present population of these islands.

Though Prof. Finck has not gone into the material deeply enough to establish the true chart of the migrations of the two swarms, his work is of great interest and value and will serve as the base of future studies in which it will contribute to the elucidation of many problems which yet baffle solution.

WILLIAM CHURCHILL.

Reports of the Cambridge Anthropological Expedition to Torres Straits. Volume VI. Sociology, Magic and Religion of the Eastern Islanders. xx and 316 pp., Map and Illustrations. The University Press, Cambridge, 1908.

The sixth, and, in series, the final. volume of the reports of this very valuable and detailed study of the people of the islands of Torres Straits appears out of order, the first and fourth volumes being still under preparation. It deals wholly with the three small islands of Mer, Dauar and Waier and its extent is sufficiently shown by the subordinate volume title "Sociology, Magic and Religion of the Eastern Islanders." Inasmuch as Dauar and Waier are but outlying islets and scantily populated, Mer is the theatre of most of the information here recorded and the work might well have been distinguished as a study of the Miriam.

In fourteen chapters we are introduced to a knowledge of the Miriam through their folk-tales, genealogies, kinship, personal names, birth and childhood customs and the limitation of children, courtship and marriage, the regulation of marriage, funeral ceremonies, property and inheritance, social organization, trade, quarrels and warfare, magic, and religion; the several essays are credited to Dr. A. C. Haddon, Dr. W. H. R. Rivers, C. S. Myers and A. Wilkin.

All is very systematic, all very thorough and detailed. In fact it must be acknowledged that this volume is really the first introduction of the Miriam to the world. Where our debt is so great and our acknowledgment of that obligation is so frank, it seems out of place to suggest that the work might have been better done if there were more of it. This is by no means a matter of volume. The authors have apparently exhausted their capacities for research and have faithfully set down the most minute details. Objects have been measured with painful accuracy, places have been oriented, individuals have been checked up in the tables of the census of ancestors. All is very precise, most definite, the result is a museum of the Miriam.

At this point we incline to differ with the faithful recorders of this expedition. Not the lowliest of men may properly be considered a museum specimen to be set on end behind the glass of a row of cases until he has become a mummy or an anatomical preparation. Until the day of his death he moves so long as he lives and has his being, he is always manifesting his inner life and impressing it upon the outer world. The work in this volume is altogether external, a close record of things done and of objects made, very minute in the study of the result and very careful in the account of the manner of the doing and the method of the making.

But we look in vain for a note of the compulsive manhood that instigates the doing, that accomplishes the making. The anthropologist in the field should recognize that it is not enough to collect and to tag the external phenomena. With the elemental savage, above all, should he put himself in his place. His greatest duty is to get inside and to look out. In some of the dances of the esoteric cult among the Miriam it has been considered valuable to note that these steps and those are performed widdershins. The record is of great value. Some of its value we think has been obscured when it is explained that the motion is contrary to the movement of the hands of the clock. It diverts the interpretation from the solar sweep which was familiar to the Miriam before trade brought clocks to them. But the value would have been far richer if one of

these observers had been able to ascertain the reason which led the Miriam dancer to pursue this course.

Anthropological research may no longer be content with the record of the answers to its questionings of "What?", for there is always an underlying "Why?" to be answered. Anthropology without psychology must ever be a record of arid facts. The record may serve as material upon which the later student may grope his way into the soul of the men out of whom the facts have arisen. In far too many cases that must be our only material. How much easier it will be when the observer in the field puts life into his faithful fact record by adding no less faithful note of the psychology of the man under examination. WILLIAM CHURCHILL.

The Geology of the Mikonui Subdivision, North Westland. By P. G. Morgan. New Zealand Geological Survey, Department of Mines, *Bull.* No. 6 (N. S.), pp. ix-175, 29 ills., 12 maps and 2 diagrams. Wellington, N. Z., 1908.

This report deals with a small area on the west side of South Island. Portions of the district are among the wildest in New Zealand and provisions, tents, instruments, etc., had to be carried into the remotest parts of the mountain ranges. Many miles of foot-paths had to be cut, streams forded and precipices scaled.

Of special interest is the section on bird-life which is unusually full. The one-sided contest between the imported pest, the weasel, and the flightless birds, is described, as also the extraordinary migrations of some of the flying birds which migrate from far northerly islands in the South Pacific to New Zealand. The cuckoo makes a journey, each year, of about 900 miles from land to land. The zones of tree growth are also described from an ecological stand-point. The principal industries of the district are grazing, with only the most trifling development of the growth of cereals and root-crops. Mining has become an important industry and the major part of the report deals with those geological features related to the development of this industry.

The alpine chain of North Westland is part of an ancient peneplain uplifted by mountain making movements to its present position. The western portion descends in an indistinct, step-like fashion to the shore, but along lines parallel to the main axis of the mountains the summits have accordant altitudes that suggest an ancient baselevel of erosion though it is not certain, from the detailed descriptions, whether this interpretation can be accepted without further analysis. The flat tops of the hills in the foot hills area are the most suggestive features mentioned in the discussion. While the report as a whole represents very careful work, attention may be called to the obscure passages relating to ice erosion, p. 46; and the ineffective analysis of Hanging Valleys, p. 55, where the phases "apparently" and "one must suppose" in critical places in the argument entirely invalidate the force of the discussion concerning the ability of ice to modify valley forms. One of the most interesting features is the overthrust of schist upon river gravels and its possible indication of very recent elevation of the New Zealand Alps (p. 72). ISAIAH BOWMAN.

Chinese Immigration. By Mary Roberts Coolidge, Ph. D. x and 531 pp., and Index. Henry Holt & Company, New York, 1909. $1.75.

In 1892 the Geary bill, making it illegal for any Chinese, except diplomats

and their servants, to come or return to the United States, was introduced in Congress. In the exciting days of the discussion and the final passage of the exclusion law, Mrs. Coolidge began her studies of Chinese immigration. They were continued at Stanford University, and the data collected were used in the classroom as part of a course on Race Problems. The author's researches were finally completed with the assistance of the Carnegie Institution.

The book is an able and careful statement of fifty years of Chinese immigration into California, its social and economic results and the legislation it evoked. The author has collected and condensed in this volume all the significant events and movements that make the story of the influx of the Chinese and its consequences. The book has been written with thorough preparation and with perfect honesty and fairness.

That the author exhibits some warmth in speaking of the sufferings inflicted upon the Chinese by local politicians and mobs and by hostile and unfair legislation is not surprising and seems entirely justified by the documentary and other proofs adduced. Probably, the best national sentiment now fully endorses the conclusion which this book emphasizes, that a detestable policy towards the Chinese was adopted, and that not California alone, but the whole country was responsible for it.

The first chapter treats well of the characteristics of the Chinese people. About 100 pp. are given to the era of free immigration in the three decades from 1848 to 1882. Then follows the discussion of three decades of restriction and expulsion beginning in 1882. Under the head of "Competition and Assimilation" much information of economic interest and importance is presented in six chapters.

Time and its Measurement. By James Arthur. 64 pp. and 47 Illustrations. Reprinted from *Popular Mechanics Magazine,* Chicago, 1909.

Mr. Arthur is a successful inventor and an extensive traveller who has made a hobby of the study of clocks, watches and other time-measuring devices. He is an authority on this subject and his collection of 1,500 timepieces from all parts of the world is supposed to be the finest in existence. His description of the methods and appliances used in measuring time, from the earliest days, is full of curious matter and historic interest. The invention of time recording machines seems to have been brought about by the growing need of knowing the time at night, sun dials not being useful at that period of the day. The book is nearly equally divided between ancient and modern devices for telling the time.

History of New York Ship Yards. By John H. Morrison. 167 pp., 22 Illustrations, and Index. Scientific American Publishing Co., New York, 1909. $2.

This is a fruitful and an interesting theme and Mr. Morrison has adequately treated it. He tells the story of the development of New York ship yards from Colonial times and convinces the reader that the industry was once of far greater importance than it is to-day. He traces the development of wooden ship building in our country, describes the American clipper ship, records the time of some of its fastest voyages, and tells about dry docks, shipyard strikes, the formation of Trade Unions, launching of vessels and launching disasters and the causes of the decline of wooden shipbuilding. The work has evidently been prepared with care and accuracy.

Les derniers Jours de l'État du Congo. Par Emile Vandervelde, Professeur à l'Université Nouvelle. 198 pp. and Illustrations. Édition de la Société Nouvelle, Paris and Mons, 1909.

Prof. Vandervelde has been one of the ablest and severest critics, in the Belgian parliament, of policies that inflicted cruelty and injustice upon the black population of the Congo Free State. His visit to that country was only for three or four months, in the last days of the State before it became a Colony of Belgium; but he had studied the country so well, as a Belgian publicist, that he knew just what he wished to see, and his high position gave him unusual advantages for seeing a great deal in a short time. His book is simply the journal of his travels, a description of what he saw or learned on credible authority, with his own comments and suggestions. He saw much to commend and considerable to censure in the management of affairs during the last weeks of the old régime. He is especially severe upon the conduct of some of the government hospitals which he found in a disgraceful condition. On the whole, he saw great amelioration in the conditions that had oppressed the blacks. He found much that is hopeful in the prospects of the colony, for its resources are undoubtedly great and may be made a blessing to the natives and the whites. This book by a man of affairs, a keen observer and a good writer is one of the best that has recently appeared on the Congo.

Through the Yukon and Alaska. By T. A. Rickard. xiii and 392 pp., 175 Illustrations, 9 Maps and Index. Mining and Scientific Press, San Francisco, 1909. $2.50.

An interesting volume describing the author's experiences in travelling over 8,000 miles through Alaska and the Yukon district in 1908. The volume is not, however, merely a traveller's tale, for much attention is given to the history of development of the mining centers visited and to chronicling stories of the "early days" that have already become legends, so rapidly have events moved in the gold regions of Alaska in the last few years. The account begins with the start from Seattle and describes in turn Juneau, Sitka, Skagway, White Horse, Dawson, Fairbanks, St. Michael, Nome, and thence back to San Francisco. Other chapters describe the natives, the development of mining methods, the possibilities of Arctic agriculture and many other phases of life in Alaska that would ordinarily be neglected in a more technical account of the country.

The author is keenly alive to the beauties and to the hardships of life in the far north, has a thorough understanding of mining methods and knows the geology of the area through its literature. He has refrained from including details of a scientific nature, however, except where such details are necessary for the purposes of his book. He has presented an attractive account of human conditions in the mining sections of the far north and has recorded many phases of life that are rapidly being superceded.

As a contribution to the history of the Alaskan gold rush and as a statement of conditions as they existed in 1908, the volume deserves a place of importance in the literature dealing with the areas described.

An Outline Review of the Geology of Peru. By G. I. Adams. The Smithsonian *Report* for 1908, pp. 385-430, with plates 1-5, Washington, D. C., 1909.

Mr. Adams was employed by the Peruvian Government for hydrologic studies.

The results of several years' labor have appeared in detail in various bulletins of the Corps of Engineers of Mines, Peru. In addition to these excellent reports there is now supplied in this important paper a résumé in English of the results of geologic investigation in Peru from the earliest times. The value of the résumé may be judged by the fact that it includes the essentials of many publications not only in Spanish but also in English, German and French, the interpretations from these sources being controlled by the personal observations of the author.

Of special merit are the maps appended to the text. These are five in number, representing not only the general outline features of the relief of the country but also, in a set of four detailed maps, the hydrography of the coastal region all the way from Paita in northwestern Peru to Tacna on the south. On these maps also appear the approximate boundaries between the region of general rainfall and the arid region of the coast in the lee of the mountains. There is also brought out the distinction between the various sub-regions of the coast.

There are three coastal plain tracts where irrigation is extensively practiced and, intervening, are two mountain tracts in which are a number of irrigated valleys whose lower courses are irrigated but whose upper courses, "the heads of the valleys," are too steep and rocky for cultivation. All told, the coastal valleys of Peru are some thirty in number and constitute the richest agricultural sections of Peru. The writer discusses the evidence for the three-fold subdivision of the Andes of Peru which extend in roughly parallel chains from the Knot of Vilcanote to the Marañon, except where the ranges unite at the Knot of Cerro de Pasco; and presents a sketch of the growth of knowledge concerning the nature of the mountains, their extent, natural classification, and drainage. A number of approximate cross-sections illustrate the structural features of the coastal plains and mountains and also the Andes. Climatological data are included for Lima, Ica, and Cailloma. An unusually complete and useful bibliography completes the article. It is a matter for congratulation that we now have in English this extremely valuable paper on the general geology of Peru.

ISAIAH BOWMAN.

The Mississippi. Report by a special Board of Engineers on Survey of the Mississippi River from St. Louis, Mo., to its mouth with a view to obtaining a channel 14 feet deep and of suitable width. 532 pp., Maps and Atlas. Submitted by the Chief of Engineers to the Secretary of War. 61st Congress, 1st Session, House Doc. No. 50. Gov. Print. Off., Washington, 1909.

This report embodies many of the conclusions reached by students of the Mississippi and supplies, in addition, much new material. The interesting part of it is the discussion of methods for obtaining and maintaining the 14-foot channel. The Board names seven: dredging, regularization, canalization with movable dams, canalization with fixed dams, lateral canals, reservoirs and a combination of methods.

With regard to improvement by reservoirs, the Board decides that such a method is, for the present at least, impracticable. This conclusion is based first, upon the study of storage reservoirs above St. Paul, the effects of which would not extend south of Lake Pepin, 51 miles below St. Paul; second, the length of time it would take for the released water to be effective at St. Louis, this time, for reservoirs above St. Paul, being at least two months, which interval would

make forecasts impossible; third, the amount of water which would have to be impounded in order to attain a 14-foot depth at St. Louis, an amount about ten times what has yet been found possible.

The Board reaches the conclusion "that the most practicable method of obtaining and maintaining a navigable channel of 14 feet deep from St. Louis to Cairo is by the completion of the project of 1881 for partial regularization in such way as to secure a permanent controlling depth of 8 feet, and then to rely upon dredging for securing and maintaining any further increase of depth." While a 14-foot waterway is considered practical, the desirability of it is questioned on the grounds that lake and ocean vessels could not navigate the channel which is tortuous and, at times, swift; nor would such a depth be sufficient for a loaded freighter. It is furthermore implied that the best use of the river will be realized by using special river barges having a draft of not more than 9 feet; these barges will be capable of carrying all the freight now seeking a water highway at a cost comparable to that of other means of transportation; and a 9-foot regulated river is easily within the range of a moderate expenditure and a small maintaining corps.

Another common argument is rebutted in this volume by the assertion that the decline in the commerce of the river has not arisen from the lack of a navigable channel for vessels of large draft but from the reduction in amount of material available for shipment. The shifting of the centers of output in recent years will explain the falling off in the river commerce.

The investigation of this problem of river conservation and use has been undertaken with great care and thoroughness, and the latitude of the work may be comprehended from the reports on many allied topics, such as, the physical characteristics of the Mississippi river, past and present projects for improvement, present and prospective commerce, gauge readings and discharge measurements. The discussion of that part of the report of the committee on Rivers and Harbors (H. R. 20686, 61st Congress) which pertains to the Mississippi river, before the present Congress, is not intelligible without a knowledge of this report.

With the report is published a large atlas which contains many maps of the river on which are plotted the projects discussed, and in addition, a wealth of data in hydrographs, profiles and typical cross-sections. R. M. Brown.

My Life in China and America. By Yung Wing. vi and 286 pp., Appendix and Index. Henry Holt & Company, New York, 1909.

The autobiographical details of this most interesting volume illuminate the upbuilding of the oldest of the nations, and in the illumination the personal details sink into the background. Those of us who know Yung Wing will find a pleasure in reading this simple story of his struggle out of the Orient into the stream of the advance of our culture. It is a pathetic tale, its personal interest is very great.

But when we seek to examine this personal accomplishment of one Chinaman against the background of the tradition and conservatism of the Middle Kingdom, we see in one glance how great was his accomplishment and then we lose sight of the individual. In the glow of his accomplishment he is lost to view.

Briefly put the record is that Yung Wing came to this country, overcame all obstacles almost with no helping hand, took high place at Yale and, in his

acquaintance with American thought and Occidental culture, became of value to the Dragon Throne. Had it been given to him to return to China and remain with his new stores of knowledge he might readily have progressed through the line of preferment to yellow jacket and peacock plume and bright red button of the advancing mandarin.

But for China he was most useful in the capacity of pioneer. He had won his way through great hardship and he had accomplished much. Awaking China determined that youth selected from her best should attain to at least as much, and that the accomplishment should be without the hardship that had hampered her pioneer, though no difficulty could do more than delay him. He was commissioned to remain away from his home for many long years. He was to serve as, in some sort, a scholastic consignee to whom were despatched from time to time invoices of Chinese youth for education in the great West. Yung Wing's first duty was to make such provision for the young students sent from home into the unknown system of an alien civilization that there should be none of the hardship through which he had so painfully made the track. A second duty was to see to it that the years of study in a culture non-Confucian should not rob the Middle Kingdom of the heart of her young sons who were sent into what many considered the land of devils, sent at the age of the greatest facility in receiving impressions.

In this autobiography Yung Wing is characteristically modest. He does not give us to see how well he performed this task of double difficulty. That omission is not difficult to supply. Many of us, a generation ago, were thrown at college into the chance of intimate acquaintance with Yung Wing's boys. We could estimate them in the classroom and in the hours of recreation and we found them no laggards in either. When they had reached the dignity of the American degree they went home to take up the work of China. But Yung Wing remained, an exile of service, to take still newer boys and to fit them to hold their own in competition with American youth. He lived far from the honors and the preferments of the Throne, devoting his life and his powers to fitting others for the honors which he would so well himself have adorned.

And at the other end, we have record of Yung Wing's accomplishment. China gave him Chinese boys to train, to China returned, from his hand, men of Western education, better Chinese. These are now men of fifty, they have served their state in high capacity and they have earned honors. The alumni rolls of our colleges show what they have done. They have become mandarins in rank, governors and ambassadors and generals in service, leaders all and not a one caught in the swirl of palace intrigue.

It is just as well not to forget that Yung Wing made these men. It is in their honors that his reward must be sought. WILLIAM CHURCHILL.

Court Life in China. The Capital, its Officials and People. By Isaac Taylor Headland. 372 pp., Illustrations, and Index. Fleming H. Revell Company, New York, 1909. $1.50.

Prof. Headland has seen the portal of the Forbidden City open and he has walked in, his eyes have rested upon the abode of the puppet emperor and of that masterful woman who for half a cycle of Cathay stood out as the one great figure. He and his wife, for not the least instructive chapters of the volume are credited to Mrs. Headland's note book, have opened, in friendly intercourse, the

equally forbidden doors of the homes of great princes. An unexampled opportunity, but the result is somewhat disappointing. It is as though the doors set wide disclosed an inner screen; we do not seem to glimpse, far less gaze into, the life which lies behind the gate and on the other side of the screen.

The first third of the volume is taken up with the account of the Dowager Empress. These chapters are essays in interpretation of the character of a woman who made herself great in a community where women are small. There is dearth of facts which might serve as data. There is a marked lack of the power to penetrate into the heart of a society whose ethics, minor as well as major, differs in externals so widely from our own. Prof. Headland's essays are illuminative. They present a picture of the empress with a wealth of detail such as is exhibited in no other record. The same is to be said of the three chapters on the emperor Kuang Hsü. Yet we must recognize that the illumination is but a brighter glow of light upon the superficies; the two great figures may photograph better, the result is after all but a photograph and not a portrait. The baffled investigator of such an alien culture may make his peace with his conscience by reciting the chant of east and west that never shall the twain meet, a confession of failure. Prof. Headland shows himself an admirer of the empress, but that her character has baffled his understanding is manifest in his inability to account for her stand in the Boxer troubles, that conservative reaction of old China against the new life felt upon the fringes of the empire.

In the present epoch of the Middle Kingdom, an infant making the sacrifices to the ancestors, and a regent reigning in his name, this book will certainly remain for some time the source whence will be derived much of our Western acquaintance with names at present great. How long they will remain great it is impossible to foretell. The gates of the home of the Manchu princes have closed, the doors of the Forbidden City have snapped shut, and always behind them remains that screen which decorates so much, hides so much. Yet before the closing of the doors, Prof. Headland has drawn a helpful sketch of Prince Chun, the regent, upon whom so much will depend. With riper appreciation, probably by reason of the greater opportunity for free acquaintance, he has sketched the career of Yüan Shih-kai. He indulges himself in the hope that his career is not ended by his retirement to a far province to nurse a rheumatism in the leg. Before that sentence was pronounced upon him he was suspected of the murder of Kuang Hsü. Before that again he was a leader of a liberal China.

WILLIAM CHURCHILL.

Rocky Mountain Wild Flower Studies. An account of the Ways of some Plants that Live in the Rocky Mountain Region. By Burton O. Longyear. xv and 156 pp., Illustrations from Nature, by the Author, and Index. Author's Edition, Fort Collins, Col., 1909. [The author, professor of botany in the State Agricultural College of Colorado, tells the story here of a considerable number of the Rocky Mountain plants. He is an enthusiastic naturalist, his talks are written *con amore* and make pleasant and edifying reading. They will help teachers to teach, and pupils and general readers to learn the ways of plants.]

The Lure of the Indian Country and a Romance of its Great Resort. By Oleta Littleheart. 145 pp. and many Photo-engravings. A. Abbott, Sulphur,

Oklahoma. Leather, $1.; paper, 25c. [No harm at all, but it was not necessary to weave even a true love story into this interesting narrative of the passing of the old régime in the Indian Territory and its absorption as a part of the lusty state of Oklahoma. The author gives the history of that momentous period of the transformation, of the rise of the astonishing little city of Sulphur, of the resources that bless the land, and reveals much of the inner life and ambitions of the Five Tribes. She is a daughter of this Indian country, knows what she describes and tells her story vivaciously.]

Times of Sunrise and Sunset, in the United States. By Robert Wheeler Willson, Professor of Astronomy in Harvard University. Harvard Coöperative Society, Cambridge, 1908. $1.25. [A series of 48 maps plates, four for each month, each containing two maps, the upper to be used for finding the standard time of sunrise for the date at the head of the page, the time of sunset being found from the lower map. Simple rules are given for using the maps. Away from large towns, this work should often serve a useful purpose.]

Visitors' Guide to Westminster Abbey. By Francis Bond. 93 pp., 12 plans, 36 photographs and other Illustrations. Henry Frowde, Oxford University Press, London & New York, 1909. 1s. [A little book for the pocket dealing chiefly with the monuments and other objects of interest in the church and cloisters. Especially adapted for visitors who have only limited time.]

Wie sollen unsere Mittelschüler die Alpen bereisen? Technische Anleitungen und wissenschaftliche Anregungen von Ernst Enzensperger. 123 pp., Illustrations and Bibliography. Jos. Kösel'sche Buchhandlung. Kempten u. München, 1909. M. 1.50. [Especially intended for students of the secondary schools who wish to pursue geological or other earth or meteorological studies in the Alps, or to observe the influence of Alpine conditions upon the human inhabitants. A good example of an elementary scientific guide for field observations.]

Drumkey's Year Book for East Africa. 1909. Being a complete Calendar, Directory and Gazetteer for the British East Africa and Zanzibar Protectorates, and containing Infomation about Uganda and German East Africa. By Y. S. A. Drumkey. vi and 394 pp., and 2 Maps. Nairobi General Agency, Nairobi, British East Africa, 1909. [A compendium of information on the regions treated and indispensable to business men, tourists and sportsmen in tropical East Africa.]

Das alte Rom. Sein Werden, Blühen und Vergehen. Von Dr. Ernst Diehl. 126 pp, Illustrations, Maps and Index. Quelle & Meyer, Leipzig, 1909. M. 1.25. [The author, a professor in Jena University. gives here a concise and clearly written description of the situation, surface features and climate of Rome, the development of the ancient city and the characteristic buildings of the royal, republican and imperial epochs, illustrated by a series of photographic views or drawings and maps.]

Norway, Sweden and Denmark with Excursions to Iceland and Spitzbergen. Handbook for Travellers by Karl Baedeker. Ninth Edition, Revised and Augmented. lx and 468 pp., 43 Maps, 26 Plans and several Panoramas. Karl Baedeker, Leipzig, and Charles Scribner's Sons, New York, 1909. M. 8. [A Summary of the Norwegian and Swedish grammars with vocabularies and lists of phrases is appended. This English edition is of great convenience to

American tourists. Heights are given in feet in the text, and in meters on the maps.]

A Paper on the Ordnance Survey. By Col. Sir Duncan Alexander Johnston, late Director-General of the Ordnance Survey. With discussion. Reprint from *Trans.* of The Surveyors' Institution, Vol. 41, Part 5, pp. 155-198, London, 1909. [Gives a brief, historical sketch of the Ordinance Survey and then treats especially of the cadastral or large scale maps which form the basis of the topographical maps. It gives a full insight into the care used in preparing, and ensuring the accuracy of the Ordnance maps.]

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NEW MAPS

NORTH AMERICA

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, May, 1910. [On the reverse are a short history and ephemeris of Halley's Comet.]

Pilot Chart of the North Pacific Ocean, May, 1910.

WEATHER BUREAU CHARTS

Meteorological Chart of the North Atlantic Ocean, June, 1910.

Meteorological Chart of the South Atlantic Ocean, June, July, August, 1910.

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California. Map of the San Francisco Bay Region showing Distribution of shell heaps. 1 inch=2.5 miles. Illustrates "Shellmounds of the San Francisco Bay Region," by N. C. Nelson. Univ. of Cal. Pub. in Amer. Arch. and Eth., Vol. 7, No. 4. Berkeley, 1909.

New York. The Indian Occupancy of the Niagara Frontier. No Scale. By Frederick Houghton. Illustrates "Indian Villages, Camp and Burial Sites on the Niagara Frontier" (same author). *Bull.* Buffalo Soc. of Nat. Sci., Vol. 9, No. 3, Buffalo, 1909. [Black sketch map.]

New York. Map of Port Henry and Vicinity. 1:63,360=1 mile to an inch. Contour interval, 20 feet. In N. Y. State Museum *Bull.* 138, Albany, 1910. [Location of iron mines indicated by numbers referring to the text.]

New York. Geological Map of the Elizabethtown-Port Henry Quadrangles. 1:62,500=0.9 mile to an inch. Contour interval, 20 feet. Illustrates N. Y. State Museum *Bull.* 138, Albany, 1910. [The map includes the work both of the U. S. and the N. Y. State Geol. Surveys and is accompanied by a sheet showing geological sections along lines indicated on main sheet. Colors show geological detail.]

Porto Rico. Road and Railroad Map of Porto Rico. No Scale. With Reports of Governor and other Officials of Porto Rico, in *Annual Reports* of War Department, Vol. 9, Washington, 1909. [A black sketch map showing wagon roads and railroads in operation or projected.]

Virginia. Map of the U. S. Navy Yard, Norfolk, Va. 1 inch=600 feet. With "The Development of the Norfolk Navy Yard," by Civ. Eng. A. C. Cunningham. In *Proc.* U. S. Naval Inst., Vol. 36, No. 1, Annapolis, Md., 1910.

West Virginia. Map showing approximate Location of diamond drill holes described in Vol. 2 (A) of Reports of W. Va. Geological Survey. 1 inch=4 miles. I. C. White, State Geologist. Drawn by Ray V. Hennen, Ass't. Geologist. Morgantown, 1908. [The borings were made during investigations of coal resources of the state.]

West Virginia. Map of West Virginia showing Railroads and County Products, 1905. 1 inch=12 miles. I. C. White, State Geologist. Drawn from Government and other Surveys by Ray V. Hennen. W. Va. Geol. Surv., Morgantown, 1910. [The varous railroad lines shown in differing colors. Tables of principal products of each county and other statistics.]

West Virginia. Map of W. Va. showing coal, oil, gas and limestone areas. 1 inch=7 miles. Geologic Features by I. C. White, State Geologist. Base map by Ray V. Hennen, Ass't. Geologist, from topographic sheets of U. S. Geol. Surv. W. Va. Geol. Surv., Morgantown, 1908. [A good economic map showing mineral and gas areas in colors, with brown contours of elevation. The coal mines are numbered with reference to list of mining companies on margin.]

Canada. (a) Atlas of Canada. No. 7: Minerals. 1 inch=100 miles. [Colored symbols for distribution of minerals south of 68° N. Lat.]; (b) Map of the Dominion of Canada. 1 inch=100 miles. [Showing, in red, the wheat area in Manitoba, Saskatchewan and Alberta surveyed up to Jan. 1, 1908, with points farther north where wheat has been grown]; (c) 20 Maps of Canada on one sheet showing temperatures, isotherms, isobars, precipitation, rainfall, snow-

fall and average possible hours of sunshine in the summer months; (d) Northern Canada. 1 inch=25 miles. 52°-60° N.; 93°-120° W. [Showing navigation, quality of soils, distribution of timber, etc. Illustrate "Canada's Fertile Northland." Dep't. of the Interior, Ottawa, 1907.]

CANADA. Explored Routes in a portion of Northwestern Ontario traversed by the National Transcontinental Railway between Lake Nipigon & Sturgeon Lake. 1 inch=4 miles. 49° 50′-51° N.; 88° 30′-91° 45′ W. With "A Geological Reconnaissance of the Region traversed by the Nat. Trans. R.R. between Lake Nipigon and Clay Lake, Ont." By W. H. Collins. Dep't. of Mines, Geol. Surv. Branch, Ottawa, 1909, No. 1059. [Geological formations in colors.]

SOUTH AMERICA

ARGENTINA. Geologische Übersichtsskizze des südöstlichen Chubuts. 1:500,000=7.89 miles to an inch. With "Geologische Beschreibung der Umgebung des Sees Musters in Patagonien," by Richard Stappenbeck. In *Sitzungsber.* d. k. Akad. d. Wissens., Math.-Naturwissens. Klasse, 117 Band, 9 u. 10 Heft., Abt. I, Vienna, 1908. [10 colored symbols for formations.]

CHILE. Karte von Chile u. d. angrenzenden Gebieten Argentiniens u. Boliviens unter Zugrundelegung d. Stieler'schen Karte, photolithographisch vergrössert, u. unter d. Redaction von Dr. L. Friederichsen d. Martin'schen Landeskunde von Chile angepasst. 1:5,000,000=78.9 miles to an inch. L. Friederichsen & Co., Hamburg, 1909. [Illustrates "Landeskunde von Chile," by the late Dr. Martin. Boundaries in red, symbols for towns according to population, and a large variety of other information.]

AFRICA

ANGLO-EGYPTIAN SUDAN. Stations at which Rainfall was measured in 1908 in the Basin of the Upper Nile. 1:7,500,000=118.35 miles to an inch. In "The Rains of the Nile Basin and the Nile Flood of 1908," by Capt. H. G. Lyons. Survey Dep't. *Paper,* No. 14, Surv. Dep't., Egypt, Cairo, 1909. [A black Map indicating rainfall stations.]

ANGLO-EGYPTIAN SUDAN. The Sudan Province of Kordofan. 1:2,000,000=31.56 miles to an inch. With paper "Notes on Kordofan Province," by Captain Watkiss Lloyd. *Geog. Jour.,* Vol. 35, No. 3, London, 1910. [Shows a network of tracks cleared or being cleared, other routes, telegraph, water courses, large nomenclature, etc.]

BELGIAN CONGO. Carte des Concessions de l'Union minière du Haut Katanga. 1:2,000,000=31.56 miles to an inch. With paper "Les Gisements miniers du Katanga" in *Le Mouve. Géog.,* Vol. 27, No. 8, Brussels, 1910. [Shows, in colors, the copper, tin, gold, iron and coal areas with mining concessions.]

BRITISH-FRENCH SUDAN. Lac Tchad. Aspect en Avril, 1908, tel qu'il résulte des levés faits de Novembre, 1907 à Mai, 1908. Par Capt. Tilho (and other members of the Tilho Mission, the work of previous explorers also being used). 1:500,000=7.89 miles to an inch. Illustrates "Le Tchad et les pays-bas du Tchad," by Capt. Jean Tilho. *La Géog.,* Vol. 21, No. 3, Paris, 1910. [Gives, in colors, the results of the most thorough survey of the lake yet made, showing

its rapid desiccation, many routes through the lake, soundings and elevations in meters, points astronomically determined, etc., together with a large amount of information on the country for 2° north of Lake Chad.]

CAMEROONS. Reisewege der Kamerun-Expedition, 1907-08. 1:2,500,000=39.4 miles to an inch. With "Forschungs-Expedition in das Kamerun-Gebirge und ins Hinterland von Nordwest-Kamerun." By Dr. K. Hassert. *Zeits.* d. Gesell. f. Erdkunde zu Berlin, No. 1, Berlin, 1910. [Showing routes of the explorers with elevations in brown.]

EGYPT. Distribution of Iron Ores in Egypt. 1:3,000,000=47.34 miles to an inch. In Surv. Dep't. *Paper* 20, "Distribution of Iron Ores in Egypt," by W. F. Hume. Geol. Surv., Cairo, 1909. [Black map showing iron ore distribution between the Mediterranean and Wadi Halfa and from the Libyan oases in the west to the Red Sea in the east.]

GERMAN EAST AFRICA. Stadtplan von Daressalam. 1 inch=550 meters. Illustrates "Daressalam" in *Deut. Kolonialz.* Vol. 27, No. 6, Berlin, 1910. [Black.]

LIBERIA. Libéria. Itinéraire suivi par M. Moret, de Cribo à Sinoe. 1:750,000=11.84 miles to an inch. With "À travers le Libéria (same author). *La Géog.,* Vol. 21, No. 1, Paris, 1910. [A black map with many new place names.]

LIBERIA. Prismatic Compass Traverse in Liberia. By Capt. C. Braithwaite Wallis. 1:500,000=7.89 miles to an inch. With paper "A Tour in the Liberian Hinterland" (same author), in *Geog. Jour.,* Vol. 35, No. 3, London, 1910. [Includes approximate boundaries of Chiefdoms.]

MAURITANIA. Mauritanie orientale d'apres Lieut. Laronne. 1:2,500,000=39.4 miles to an inch. Illustrates "La Mauritanie orientale" (same author), *La Géog.,* Vo.l 21, No. 4, Paris, 1910. [A black map giving a large amount of new data relating to this little known region in the southwestern Sahara.]

RHODESIA. Map of Northern Rhodesia and adjacent Territories, showing Faunistic Areas. 1:5,000,000=78.9 miles to an inch. By S. A. N. Neave. With paper "A Naturalist's Travels on the Congo-Zambezi Watershed." *Geog. Jour.,* Vol. 35, No. 2, London, 1910. [Three tints to show areas of South, Central and West African Fauna.]

SAHARA. Approximate Distribution of Sand Dunes of the Libyan Desert. 1:7,500,000=118.35 miles to an inch. By H. J. L. Beadnell. 24°-32° N.; 22°-34° E. With paper (same title and author), in *Geog. Jour.,* Vol. 35, No. 4, London, 1910. [Showing geological formations and the dune regions.]

SAHARA. Itinéraires parcourus par le Capitaine Cordier dans le Pays des Ioulliminden. 1:5,000,000=78.9 mils to an inch. 15°-20° N.; 2° 20′ W.-7° E. of Paris. Illustrates "Le Pays des Touaregs Ioulliminden." *La Géog.,* Vol. 21, No. 4, Paris, 1910. [A black map giving the itineraries of Capt. Cordier. All locations noted on his routes were fixed astronomically.]

SAHARA. Croquis schématique des Territoires au nord-est du Tchad. 1:5,000,000. Illustrates "Les régions au nord-est du Tchad (Mission de délimitation Niger-Tchad-Mission Tilho)." *La Géog.,* Vol. 21, No. 4, Paris, 1910. [A black map showing the Mission and other itineraries and some new place names, wells and surface features.]

TUNIS. Situation agricole des Territoires du sud Tunisien. No Scale. Illustrates "Note sur la Situation économique du Sud de la Régence de Tunis, et sur l'Avenir de cette Région." *Bull.* Sec. tunisienne de la Soc. Géog. Comm. de Paris, No. 2, Tunis, 1909. [Colored to show sources of artesian wells, and regions favorable for the cultivation of the palm and olive.]

ASIA

ASIATIC TURKEY AND W. PERSIA. Part of Kurdistan. 1:2,000,000=31.56 miles to an inch. 35°-40° N.; 41°-47° E. With paper by Capt. Bertram Dickson, "Journeys in Kurdistan." *Geog. Jour.,* Vol. 35, No. 4, London, 1910. [Colors differentiate leading topographical features.]

ARABIA. Sketch Map of North West Arabia. Showing the explorations of Douglas Carruthers, 1909. 1:2,000,000=31.56 miles to an inch. With paper "A Journey in North-Western Arabia," by Mr. Carruthers. *Geog. Jour.,* Vol. 35, No. 3, London, 1910. [Based on a prismatic compass survey in the region included between 27° 30′-32° 10′ N.; 34°-40° E.]

CHINA. Part of Western Sechuan. 1:1,000,000=15.78 miles to an inch. From a Plane table Survey by J. W. Brooke. Illustrates "Mr. J. W. Brooke's Journeys in Western Sze-chuan." By C. H. Meares. *Geog. Jour.,* Vol. 34, No. 6, London, 1909. [The map contains the results of Mr. Brooke's surveys up to a short time before he was murdered by the Lolos, about the end of 1908.]

HIMALAYA. The Hispar Glacier and Tributaries in the Karakoram Range, explored by the Bullock Workman Expedition, 1908. 1:150,000=2.38 miles to an inch. With paper "The Hispar Glacier," by Dr. and Mrs. Workman. *Geog. Jour.,* Vol. 35, No. 2, London, 1910.

INDIA. India, showing the Progress of the Imperial Surveys to 1st October, 1908. 1 inch=128 miles. In *General Report* of the Survey of India during 1907-08. Calcutta, 1909. [Colors show areas covered by completed or progressing topographic surveys, by the various revenue surveys and by geographical reconnaissance, on various scales.]

MESOPOTAMIA. The Tigris-Euphrates Delta. 1:3,000,000=47.34 miles to an inch. Illustrates a paper by Sir W. Willcocks: "Mesopotamia: Past, Present and Future." With inset showing railroads, built or projected, between Constantinople and the Persian Gulf. *Geog. Jour.,* Vol. 35, No. 1, London, 1910. [Red tint indicates land capable of early development.]

SUMATRA (south). Schetskaart der Onderafdeeling Koeboestreken. 1:500,000=7.89 miles to an inch. Illustrates "De Koeboes in de Onderafdeeling Koeboestreken der Residentie Palembang." By G. J. Van Dongen. *Bijdragen* tot de Taal-Land-en Volkenkunde van Neder.-Indie, Vol. 7, Nos. 3-4, The Hague, 1910.

EUROPE

AUSTRIA. Verbreitung des Erdbebens vom 19 Feb., 1908, in Niederösterreich. 1:1,000,000. With "Bericht über das Erdbeben vom 19. Feb., 1908" in *Mitt.* d. Erdbeben-Kommission d. k. Akademie d. Wissens. in Wien, No. 34, Wien, 1908.

Austria-Hungary. Der Triester Karst mit seiner Höhlen und seinen problematischen unterirdischen Höhlenwässern. 1:150,000=2.38 miles to an inch. By G. A. Perko. Illustrates "Zur österreichischen Karsthöhlenforschung" (same author). In *Deuts. Runds. f. Geog. u. Stat.,* Vol. 32, No. 6, Vienna, 1910. [Shows caves, probable courses of undergound waters, surface waterpartings, etc.]

Balkans. Geologie des nördlichen Albaniens. No scale. Illustrates paper (same title), by H. Vetters, in *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907. [Formations in colors.]

Balkans. Die Vegetations Regionen der Balkanhalbinsel. 1:2,000,000=31.56 miles to an inch. By Prof. Dr. L. Adamovic. Illustrates paper "Pflanzengeographie der Balkanhalbinsel," by same author. *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907. [16 symbols in colors to show distribution of flora.]

Balkans. Vegetationsgrenzen, Verbreitung, Areal u. Standorte d. wichtigsten Holzgewächse d. Balkanhalbinsel. 1:3,000,000=47.34 miles to an inch. By Prof. Dr. L. Adamovic. *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907.

Balkans. Pflanzengeographische Karte Bulgariens, Ostrumeliens, Nordthraziens und Nordmazedoniens. 1:750,000=11.84 miles to an inch. Illustrates paper (same author) "Die Verbreitung der Holzgewächse in Bulgarien und Ostrumelien." *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 84, Vienna, 1909.

France. Glaciers du Massif des Grandes-Rousses. 1.10,000=0.1 mile to an inch. With "Travaux topographiques et glaciologiques dans le massif des Grandes-Rousses," by G. Flusin and Ch. Jacob. *La Géog.,* Vol. 21, No. 1, Paris, 1910. [Mountains in brown, blue contours for elevations of glacier surfaces, symbols for moraines, etc.]

France. Tremblement de Terre du 11 Juin, 1909. Intensité de la Secousse principale. Carte dressée par A. Angot. Illustrates paper (same title) by A. Angot and P. Lemoine. *Annales de Géog.,* Vol. 19 (No. 103), Paris, 1910. [Shows, in colors, the degrees of intensity noted according to the Forel-Mercalli Scale.]

Rumania. Formarea Deltei Dunarei. 1:400,000=6.3 miles to an inch. Illustrates paper (same title) by Captain M. D. Ionescu in *Buletin,* Rumanian Geog. Soc., Vol. 30, No. 1, Bucharest, 1909. [Map, in colors, of the Danube Delta.]

WORLD

Maps of the Continents. Mercator Projection. (a) Biographische Gliederung d. Kontinente; (b, c) Ausbreitung d. Säugetiere, 1 & 2; (d, e) Ausbreitung d. Reptilien, 1 & 2; (f) Ausbreitung d. Amphibien u. d. Dipnoer; (g) Gebirgskarte d. Erde; (h) Karte d. Gezeitenwirkung u. d. tetrædrischen Deformation; (i-r) 10 Karten d. Kontinente während des Kambrium, de Silurzeit, Devonzeit, Karbonzeit, Triaszeit, Jurazeit, Kreidezeit, älteren Tertiärzeit, jüngeren Tertiärzeit, Diluvialzeit; (s) Ausbreitung der Menschenrassen. [Maps in colors illustrating "Die Entwicklung der Kontinente und Ihrer Lebewelt," by Dr. Theodor Arldt.]

BULLETIN

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EXPERIMENTS IN GEOGRAPHICAL DESCRIPTION*

BY

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The Present Condition of Our Association

The exploration of unknown lands and seas has, to my regret, seldom been the subject of essays presented before our Association. It would appear that most of those who are active or bold enough to make their way far from the beaten track do not care for the more thorough study of geography to which we are pledged; or perhaps that we, with our interest in the more scientific and analytical aspects of geography, have not been sufficiently cordial to those explorers who go far from home and bring back narratives in which personal adventure almost necessarily has a large place. Nevertheless, we have not been altogether wanting in this respect. We have heard in earlier meetings something of the desert basins of inner Asia, of the lofty plateaus of the Andes, and of the great territory of Alaska; and I trust that we shall again from time to time have reports on distant parts of the world, particularly when they can be presented with such technical geographical skill as characterized the papers just referred to. Some such papers are listed in our program for this meeting, but if I thus call especial attention to the recent studious travels of Messrs. Woodworth, Huntington and Martin, it would be unfitting not to add at least a few words on the extraordinary geographical achievements of the year now closing; a year that has

* Presidential address at the meeting of the Association of American Geographers held in Cambridge, Mass., Dec. 30, 1909, modified and extended in certain points.

brought us the news of the most remarkable advances in polar exploration ever made. Although our own work is mostly performed in well-known lands, we must recognize and admire the brave strength of purpose, the persistence in the face of exhausting hardships, which enabled Peary to reach one pole and Shackleton so very nearly to reach the other.

The work of our members has naturally been limited for the most part to our own country. It was at first feared that it might also be limited too closely to the physiography of the lands, because so many of us had been more concerned with that division of geography than with any other; but if we have at any time deserved that reproach, the meeting of last winter at Baltimore merited and indeed received altogether different comment; for Professor Penck, who was then our guest, described it as giving a well-distributed attention to various phases of our subject; and Dr. Gilbert, our president at that time, considered the meeting to be a thoroughly serious and scientific assembly. These two opinions are surely most encouraging; yet we still have work to do in the way of broadening our relations. We would willingly see oceanography and climatology more fully represented on the inorganic side of geography, and on the organic side there is pressing need of more attention to the geography of plants, animals and man than has yet been given. We therefore have abundant room for expansion, and I beg each and all of you to use all appropriate efforts to make our needs known in these several directions. As a practical step in this direction, I suggest that we invite representatives of allied subjects, such as history, economics and biology, to address us from time to time on their conception and use of geography.

We have, I believe, still the distinction of being the only geographical society in the world in which some definite geographical accomplishment is required for membership. I trust that such a qualification will be carefully maintained. We have probably the further distinction of being the smallest geographical society in the world; we are indeed so small that it is difficult and disappointing to believe that all the trained and productive geographers in North America are included in our list of some eighty names. Let me, therefore, commend the discreet nomination of new names to the council, always provided that the nominees have reached the stage of studious and original geographical production; and let me even more particularly advise that personal invitation be given to earnest younger students of geography to attend our meetings as

guests of the association, in the hope that what they see and hear among us will encourage them to secure serious professional equipment and to reach active production in geographical science. In due time, they having become members, it will be their turn to maintain our simple organization and to foster its fuller development.

Examples of Unsystematic Description

The particular subject on which I wish to address you to-day concerns, as you might expect, the study of land forms, and more especially the manner in which land forms may be effectively described by mature observers, so that they may be appreciated by mature readers. Let me consider with you whether it is desirable and practicable to make at least some approach to systematic methods in describing the landscapes with which every geographer has to deal in the narrative of his travels, or in the account that he gives of particular areas in his regional studies. My own answer to this question is decidedly in the affirmative, and I propose to illustrate at once the need and the value of some sort of systematic method by the rather invidious device of giving an example of unsystematic description, taken from the first geographical journal on which my hand happened to fall after the intention to cite such an example was formed. The following abstract, therefore, presents all the statements concerning the structure and form of a certain mountain range, in the order in which they are presented in the essay referred to; but distances, directions and other details are changed so that the source of the abstract can hardly be identified, and a considerable amount of general description that is aside from my purpose is omitted.

The mountain mass, entirely isolated and having a very remarkable geological constitution, is a high range, which rises abruptly at its northern end in the form of a great escarpment, surmounting the plain by some 3,000 or 4,000 feet; the range continues in an almost direct course to the south for about 40 miles. The summit is of very difficult access, the rocky wall being nearly vertical and mostly bare for the uppermost 1,500 feet. There is said to be no deep pass through the range. At an elevation of 2,000 or 3,000 feet there are grassy benches. On all sides the crests are very steep, with altitudes of from 4,500 to 6,000 feet; the culminating point rising to 6,300 feet. The crest is not continuous. Erosion has dissected the top of the mountain into a multitude of knobs and small plateaus. The entire range is formed of sandstones, inclined in general at an angle of 45°, and trending like the range from north to south. The sandstones rest on granite, which reaches an altitude of 1,900 feet

at the village of Blank; while near River So-and-so the sandstones are seen at an altitude of 1,200 feet. On certain lower terraces, horizontal sandstones are deposited. The range has the appearance of constituting the eastern limb of an anticline, but it is difficult to explain in what way erosion has removed the sandstones of the western limb from the plain, since they form a heavy body in the range. Deep V-shaped valleys, parallel to one another, veritable torrent beds, are seen in large number on the eastern flank. After reaching the foot of the range, at an altitude of 1,000 feet, the torrents become quiet streams.

Part of this description is rather baffling. For example, what is the general form of the top of the mountain, in which erosion has produced a multitude of knobs and small plateaus? On reaching this statement, after having previously read that the summit is of difficult access, the upper rocky walls being nearly vertical and the crest very steep on all sides, one might make the provisional inference that the mass was of horizontal structure, like a lava-capped mesa; but this inference is not consistent with the earlier statement regarding the well defined north-south trend of the range, and it is explicitly contradicted by reading, a little farther on, that the mountain is formed of inclined sandstones. One must feel rather vexed not to be told at once in which direction the sandstones dip; for until such information is given, the reader has to keep two pictures floating in his mind; one of an east-dipping monoclinal range, the other of a west-dipping monoclinal range. But he may throw away the second picture after reading a little farther and coming to the comparison of the range with the eastern limb of an anticline, of which the western limb is lost. This is the only indication given by the observer that the dip of the sandstones is to be east. The absence of the western limb of the postulated anticline tempts the reader to suppose that the range, instead of being part of an anticline, is really an east-tilted and dissected fault-block; even though the observer, after he has himself discredited the suggestion of anticlinal structure, says nothing about this manifest possibility. Theoretical discussion is therefore as fragmentary as the record of observation. In fine, the more carefully one reads the article, the more one is impelled to say that certain important items are omitted; that such items as are mentioned are introduced in no apparent order; and that the method of treatment is uneven and arbitrary and accidental, being explanatory in one part and empirical in another.

By rearranging the facts presented, the reader may form a more systematic description. In the absence of explicit statement to the

contrary, normal erosion is naturally assumed to have caused whatever changes have been produced during the development of the existing form from the initial form. The systematic description may then proceed as follows: The range, trending north and south, with altitudes of from 4,500 to 6,000 feet, is a monocline of heavy sandstones which dip eastward, and which are underlaid by granite along the western flank. The northern termination is a high cliff; the southern end is left undescribed. (Whether the initial form of the mass was a tilted block or not must be left undecided, because no sufficient account is given by the observer either as to the constitution or the form of the lower ground from which the range rises.) The crest is somewhat dissected but not deeply notched; the eastern flank is well dissected by consequent streams; the western flank is presumably more or less ravined by obsequent streams. On the whole, the stage of erosional development may be provisionally regarded as submature or mature.

It is tantalizing to read of the grassy benches at altitudes of 2,000 or 3,000 feet, and not to be told on which side of the range they occur, or how they are related to the structure of the mass; possibly they are granite benches on the western flank. One must discount the statement regarding the nearly vertical slope of the upper rocky walls, because vertical walls are altogether improbable if not impossible on the back slope, and are hardly possible even on the front slope of a monocline. Uncertainty must also remain regarding the piedmont terraces; perhaps they are remnants of a sandstone formation that once had a greater horizontal extension; but this cannot be determined because of the vagueness of the phrase: "On certain lower terraces, horizontal sandstones are deposited." Inasmuch as erosion is explicitly mentioned as having affected the crest of the range and implicitly suggested as having ravined the eastern flank, it is unfortunate that its effects on the western escarpment and around the base of the range are passed over in silence. Uneven description of this kind is disappointing.

The point to be emphasized is that the description prepared by the observer would be much more easily apprehended by the reader if it had been orderly instead of disorderly, and thorough instead of fragmentary. Immediately following the introductory statement concerning the occurrence of a high and isolated range, trending north to south, one must wish to know its general structure; namely, that it is a monocline of heavy sandstones, dipping eastward, with a foundation of granite exposed in the western flank. After explo-

ration is finished, the preparation of brief and explicit statement of this kind surely imposes no great burden on the observer; and as surely it gives great aid to the reader. Brief suggestion as to the initial form of the mass and as to the amount of change that it has suffered since its uplift would be helpful, because the reader could then, as it were, accompany the observer in his attempt to give an explanatory account of the present form. If erosion has gone so far that the initial form is altogether uncertain, an explicit statement to that effect should be made. Normal erosion being understood to be the process engaged in carving the mass to its present form, various details regarding the dissection of the crest, the steepness of the upper slopes, and the ravining of the flanks, may be easily added in the latter part of the description in orderly fashion; and as easily apprehended. If the observer, on seeing the ravines in the eastern flank, hesitates to call them "consequent," because of the vague possibility of some other origin, he may immediately solve this difficulty by calling them "apparently consequent;" and the reader will at once catch his meaning, and also his uncertainty regarding it. If the observer hesitates to assert definitely that the mass was initially a tilted block, he may say it looks "as if" it had been uplifted as a tilted block, provided that that is really his best interpretation of the facts; and then the reader will find in this guarded statement the clue that he needs in order to gain the observer's point of view, to follow the rest of the description, and to form a good mental picture of the landscape. The essential principles here are, first, that the reader's mental picture cannot be well formed, unless the observer describes what he has seen in terms that are susceptible of definite interpretation; and, second, that the mental picture cannot be easily formed, unless the observer presents the results of his observations in a reasonable order.

Only after a definite description of the landscape has been presented, is it fitting to mention by name subordinate items, such as single villages and individual streams. It is altogether inappropriate to use unknown local names of villages and streams as a means of locating unknown structures and forms. This is a general principle that is too often overlooked. In the absence of all diagrams and maps in the article here considered, the reader gains nothing on being told, before the direction of monoclinal dip is stated, that the foundation granite outcrops near the village of Blank. He profits nothing on reading that the sandstones are seen on the banks of River So-and-so, the relation of the river to the

range being unexplained, and even the direction of river flow being unmentioned. Such items may be useful hints to a second traveller on the ground, but they are distractingly irrelevant to a reader at a distance. On the other hand, after a general statement has been given, from which the reader may form a fairly definite conception of the structure and form of the range, it may well be added that at the western base, about so far from the well defined northern end of the range, and near a large exposure of the foundation granite, lies the village of Blank; or that at the head of a certain obsequent ravine, located in such and such a way and drained by the head-waters of River So-and-so, the sandstones are reached at such and such an altitude.

The Need of Systematic Methods

The article from which these extracts are taken affords a fair sample of the treatment accorded to land forms in most of the leading geographical journals of the world and in most of the books of travel, from which we must learn nearly all that we know about distant lands. If the article here abstracted departs from the average treatment of land forms, it is rather on the side of greater than of lesser fulness of statement; but here, as well as in the great majority of geographical books and essays, the method of treatment is really no method at all, as far as this division of our subject is concerned. Such articles as those by Bowman on the Bolivian Andes (*Amer. Journ. Science,* 1909) are altogether exceptional in the clearness and fulness of their explanatory treatment. There is very seldom any indication that explorers have had in mind any well matured plan or standard, in view of which a mountain range or any other form that they come upon, should be treated. Geographical essays seldom give us reason for thinking that their authors have had any thorough training in the analysis or the description of land forms; or for thinking that they are aware of the systematic association of parts that is so generally characteristic of the elements of a landscape, or of the reasonable origin of the associated parts by the action of ordinary processes. There is not even any clear indication that the observers are consciously experimenting with any definite method for the better presentation of the facts that they have seen. The random accounts of item after item are usually arranged in indiscriminate order, as if any accidental manner of presentation were all sufficient. This is truly one of the most disappointing features of the present status of geography. The very

sources from which we ought to expect the best material—namely, original narratives in books of travel, and essays in the journals of the great geographical societies—give us records of the kind just cited, in which so important a part of our subject as land forms is as a rule treated in an utterly unscientific manner.

The prevailing absence of scientific method for the treatment of land forms may be on the one hand taken as a discouragement by those who believe that a systematic method would be helpful; for if disorderly, unscientific methods prevail at so late a time as the present, it must be, one may be tempted to say, because none can be invented. But, on the other hand, the absence of method may be regarded as an encouragement, because it shows that the field is practically clear for the introduction of any method that will generally commend itself to practical geographers. The latter point of view is to be preferred. Let me, therefore, confidently urge upon all our members who are interested in this aspect of geographical progress to give a share of their time to the invention and development of a thorough-going method for the description of land forms, a method that may find general acceptance through being generally applicable; and to make experimental trial of the method for themselves, and explain it as well as exemplify it in their publications.

As an earnest of my conviction of the importance of this work, allow me to say that I have already made some experiments of this kind myself. You may remember that, two years ago, when we met at Chicago, I had the pleasure of conducting a conference in which the discussion centered chiefly on the possibility of developing and adopting a systematic method for the description of the lands, and in which I advocated the general use of what has been called the method of "structure, process and stage" for this purpose. It is my desire to-day to carry the subject of that conference somewhat farther; partly by reviewing what was then accomplished, partly by describing to you an experiment in the same direction that I made in Europe in the summer of 1908.

One of my objects at the Chicago conference was to bring forward various other systematic methods of treating land forms, besides the one with which I was experimenting myself; but no success was reached in this direction. Several members who were present, and several absent members to whom I afterwards wrote, expressed themselves as unprepared to adopt the method of structure, process and stage in their work; but what impressed me more was that they did not propose any alternative method. Perhaps no sufficient

opportunity was given for the presentation of such an alternative; but certainly none was forthcoming, either in discussion or in correspondence. Some members stated explicitly that they preferred to remain free from any limitations; and with such a preference for freedom I have the warmest sympathy. Indeed my wish to profit from the more general introduction of a systematic method does not, to my mind, unwisely interfere with such freedom. Improvements are always in order, and everyone must of course feel free to introduce them. There are occasions, however, when some definite method of treatment has to be adopted for a time at least, as when one writes a geographical description of a tract of country, or when one presents the principles of geography to a class of students; and still more when one attempts to teach young geographers the art of geographical description. It was particularly with regard to such needs that I was interested to learn the opinions and the practice of my associates. Perhaps the title of the Chicago conference, namely, "Uniformity of Method in Geographical Investigation and Instruction," went too far; and as I am now minded, my object would be better expressed under such a title as "Experiments in the Systematic Description of Land Forms." It is especially that aspect of the subject which I wish to pursue further to-day.

A Geographical Excursion in Italy

A good test of a method of description is found in its application to new fields. It was, therefore, with much interest that I looked forward two years ago to a journey to Italy in the summer of 1908, when it would be possible to revisit certain districts of which I had had passing glances in the spring of 1899, and to determine how far they could be described according to the method under experiment. But it occurred to me that an adequate and impartial experiment with a method could hardly be secured if the person who had developed it should also be the person who had to apply it. Others of different training ought to make the test. Hence a circular letter was sent out to a number of correspondents at home and abroad, indicating a route and a plan of work, and inviting them or such of their advanced students as they could recommend to join me in Italy on June first. The success of this plan passed all my anticipations. We were favored by special permission from the Italian Ministry of War, secured through the kind offices of the American Embassy at Rome, to make field studies even near fortifications and along the frontier. We were allowed to purchase all sorts of maps, not usually

on sale, at the Military Geographical Institute in Florence. We were cordially welcomed by scientific colleagues at various points. The members of the party all entered heartily into the spirit of the work proposed, and made a most harmonious even if variegated troop. The numbers varied from four to forty or more in different parts of the route. The cosmopolitan character of the gathering was its greatest value; for under what conditions could one secure livelier incentive to geographical investigation or make a better test of a proposed method of work, than by visiting choice fields in the company of earnest students of different nationalities and different training, and discussing together the varied landscapes that opened before us. Members who accompanied the party for a week or more included teachers from the Universities of Paris, Lyons, Marburg, Genoa, Michigan, Cincinnati and North Carolina, Williams College, and the Lyceum of Oran (Algiers), as well as graduates or students from Berlin, Lille, Vienna, Bern and Cambridge (England) ; those who were with us for shorter periods represented the Universities of Grenoble, Fribourg and Harvard, the military school of Fontainebleau, and the state normal schools at Salem, Mass., and Cheney, Wash.

Our work began on June first, 1908, at Ancona on the Adriatic (A, Fig. 1,), where we studied a late mature coastal plain; and ended on July 18 at Le Puy en Velay in central France; and between times we saw the valley of the Lamone above Faenza (Fa), in the northeast flank of the Apennines, the basins of Florence (F) and of Val d'Arno within the Apennines; the plain of Pisa (P) ; the beautiful coastal forms of the Riviera Levante between Spezia (Sa), and Genoa (G), the elbow of the Tanaro valley at Bra (B), where the river has been diverted from a former northward to its present eastward course; the lakes of Como (C), Lugano and Maggiore (M), and their associated Alpine valleys, where we discussed the problem of glacial erosion; the huge terminal moraines of Ivrea (Iv), and the glaciated valley of the Dora Baltea above them to Aosta (Ao) ; the pass of the Little St. Bernard, by which

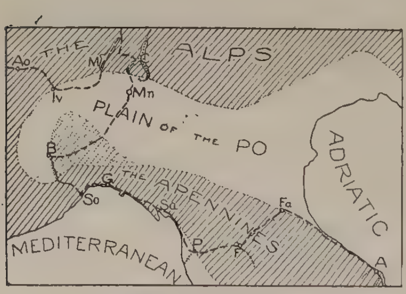

FIG. 1—Route of the Italian Excursion, 1908.

some of us crossed into France; the French Alps in the vicinity of Grenoble; and west of the Rhone the mountain belt of the Cévennes, formed by the dissection of the southeastern slope of the central plateau. It may well be imagined that we had much entertainment that was not strictly geographical; yet on the whole we held rather closely to the object of the excursion. One of the most amusing features of the journey was the necessity of using several languages in our daily intercourse; and here the European members of the party had great advantage over the Americans by their fluency in other tongues than their own. The determination taken by some of the American members to learn at least one foreign language before making another visit to Europe was not the least valuable lesson of our cooperative efforts.

The Method of Structure, Process and Stage

As in the case of the Chicago conference, the most significant result of the Italian excursion for me was again the prevailing absence among the members of the party of any conscious and matured method for the description of land forms. That the method with which I had been experimenting was not familiar to my European companions was surely not due to any recondite elements in it, for there are none; all its elements are taken from the common experience of geologists and physical geographers. In so far as the method has any novelty, it is to be found in the systematic treatment of well-known elements; and even in this respect it is not so novel as some have seemed to suppose. Its fundamental principles are to be found, for example, in the third edition of Sir Archibald Geikie's "Scenery of Scotland" (1901), where one may read:

"The problem of the origin of the scenery of any part of the earth's surface must obviously include a consideration of the following questions: (1) The nature of the materials out of which the scenery has been produced; (2) the influence which subterranean movements have had on these materials, as, for instance, in their fracture, displacement, plication, and metamorphism, and whether any evidence can be recovered as to the probable form which they assumed at the surface when they were first raised into land; (3) the nature and effect of the erosion which they have undergone since their upheaval; and (4) the geological periods within which the various processes have been at work, to the conjoint operation of which the origin of the scenery is to be ascribed" (p. 9, 10).

Here we have the very essence of what is implied under the terms

"structure, process and stage"; and I fully agree that "obviously," as used in the first sentence, is precisely the word with which to introduce what follows. Yet, obvious as these considerations are as regards the origin of scenery, it is seldom that they are completely and systematically employed by geographers in the description of scenery. Their helpful use is furthered by their systematic treatment according to a definite method; and therefore method has here a practiced value. Each member of my party knew well enough the various structures and processes involved in the production of natural landscapes, and could explain them item by item; nevertheless hardly any one had consciously adopted a particular method for presenting the results of his observations regarding the natural combinations of the items, such as occurred in the landscapes that were repeatedly spread before us.

A generally favorable consideration was given to the method of structure, process and stage, during the excursion, but this must not be taken as counting altogether in its favor. A definite method naturally makes headway as against indefinite, unformulated methods; and moreover, as I was the leader and oldest member of the party, my views probably received a greater consideration than they would have gained if I had been a junior and a follower. Still all allowances made, the excursion gave me great encouragement, and I resolved to persevere in carrying the development and the application of the method as far as possible; but always in the hopes of meeting other methods, developed by my colleagues; and always with the promise, to myself at least, to make careful trial of other methods as far as I could learn them.

The Dissected Coastal Plain Near Ancona

Let me give a few examples of our work, beginning with two excursions in the neighborhood of Ancona, where sheets 117, 118, 124, 125 of the Grande Carta topografica del Regno d'Italia, 1:100,000, served as local guides. Here the earliest members of the party, a Frenchman, a German Swiss and an Austro-Galician, were present. The results may be briefly summarized as follows: The northeastern Apennines serve as the oldland to a dissected coastal plain, some 20 or 30 kilometers in breadth, composed of unconsolidated strata of clay and sand. The dissection has been carried to a stage of late maturity by prevailingly consequent streams with short insequent branches, the largest consequents being those which have been extended across the plain from the Apennine oldland to the sea. The

oldland, although not sharply separated from the coastal plain, has a more deformed structure, a greater altitude, and a tendency to a longitudinal rather than to a transverse arrangement of its ridges. The relief of the district is moderate or small, with altitudes of 200 or 250 meters along its inner border, and of from 50 to 120 meters near the coast, where the sea has developed a fully mature line of cliffs which truncate all the sea-board hills in even alignment. The texture of dissection is rather coarse. In consequence of a slight and recent elevation, increasing from zero at the coast to 10 or 20

FIG. 2.

Diagram of the Late Mature Coastal Plain, South of Ancona, Italy; looking West.

meters at the inland border of the district, the larger consequent streams have excavated mature floods plains below the terraced remnants of their earlier valley floors; and during about the same recent period the sea has withdrawn from the maturely aligned cliffs of its former attack and prograded a strand-plain from 200 to 300 meters in breadth, which at the river mouths is broadened in faintly convex deltas of about double this measure. Hence it seems as if the recently revived rivers had rapidly washed so much waste to the sea, that the waves could not immediately dispose of all of it, and therefore deposited a part of it along the shore, thus prograding the strand plain. These features are graphically summarized in Fig. 2, an imagined bird's-eye view, looking northwest.

The essentials of the above description are, first, that it begins with a general statement from which the reader may immediately infer the total initial structure and form of the district concerned; second, that it proceeds, tacitly implying the action of normal and of marine processes of erosion, to state the stage that each of these

processes has reached in the regular progress of its work; and third, that it adds in closing a brief account of the result of a slight interruption of the first cycle of erosion due to a slanting uplift of small amount, and with the cautionary words, as if, provisionally suggests the correlated origin of two new features, the terraced valley floors, and the prograded strand plain, concerning which our brief excursions did not suffice to provide full proof.

Let us consider these points in more detail. From the term, coastal plain, which is given in the first sentence of the description, the initiated reader immediately understands a simple structural mass chiefly composed of stratified sediments, deposited on a sea floor when the region formerly stood lower than now, and when the sea had its shore on the flanks of the Apennine oldland; but now revealed as a land area, sloping gently seaward, in virtue of a broad uplift without significant deformation. Even if all this had been explicitly stated, instead of having been only implied in the term, coastal plain, the description would not have been too geological, for every point of the expanded statement bears helpfully on the appreciative understanding of the existing landscape, and hence on its proper description. Nothing is introduced simply for the sake of its geological interest, however great that may be; even the geological date of the strata concerned is left unmentioned, because this is geographically irrelevant.

It may be noted in passing that the terms, coastal plain and coast plain, have been used by some geographers to designate platforms of marine abrasion, now uplifted so as to form a littoral lowland. Geographical terminology is so little developed and systematized that no agreement as to the limitation of these and various other terms has yet been reached.

Although a marine coastal plain is in its earliest youth a smooth surface, gently inclining from the oldland to the sea, the first sentence of the description given above includes the significant word, dissected; and with this the reader must immediately pass from the conception of the initial stage of a smooth coastal plain to the later stage of a surface made uneven by the erosion of many valleys. The strata that form the plain are said to be unconsolidated, and this suffices to exclude all outcropping ledges from the present landscape, particularly as the dissection of the plain is said, in the second sentence, to have reached a late mature stage. All the hill slopes must therefore be conceived as cloaked with a creeping soil. The former shore line, marking the original inner border of the

plain must have lost whatever distinctness it may have had at the time of uplift; and it is indeed to-day hardly to be detected.

For similar reasons, all the streams must be conceived as having thoroughly well graded courses, and all but the smallest valleys must be pictured as having flood plains of gentle fall. The general pattern of the streams and their valleys is sufficiently indicated by the words, prevailingly consequent and short insequent. These must be taken to mean that the larger streams flow almost directly to the sea in sub-parallel courses about at right angles to the general trend of the plain as a whole; while many small vallley-heads branch in various directions from the trunk valleys. The hilly interfluves between the chief valleys must, in a late mature stage, be pictured as having lost something of their initial altitude, and hence, when looked at in the direction of the length of the plain, as no longer rising to a perfectly smooth and gently sloping skyline, but nevertheless as approximating to this form; while the spurs that branch from the axes of the interfluves must be pictured as generally pointing toward the sea and as descending by gentle, graceful, and well graded slopes into the open valleys. The texture of dissection being described as rather coarse, the hills and spurs must be conceived as having contour lines in flowing curves of rather large radius; and all close-set, sharp-cut ravines must be excluded.

At a late mature stage, the larger extended rivers must of course be pictured as having broad valley floors; and the sea must be imagined as having cut back or retrograded the front border of the plain, so that the coast-line hills are evenly truncated in a long succession of sea cliffs, all standing in accordant line over a well developed beach. Deltas must be absent. The general picture thus sketched must then be slightly modified by terracing the main valleys and by widening or prograding the beach into a well developed strandplain.

The technical terms here employed are few; most of them are almost self explanatory, but they are all highly significant. Consequent and insequent streams and valleys present elementary and fundamental conceptions in rational physiography. Retrogradation and progradation of a shore line by marine action correspond to degradation and aggradation of a valley floor by a stream; in both cases, the steady action of balanced forces is implied. Surely there can be no sufficient reason that the newly recognized ideas represented by these newly introduced terms should be neglected by modern geographers who employ, whenever they can, such innova-

tions as motor cars, film cameras and daylight developers. Nor need there be any fear that the mere use of such technical terms as are here suggested will necessarily result in enforcing an unattractive, non-literary style upon geographical descriptions. Attractiveness of style is a matter to be cultivated for and by itself; it is as well worth cultivating in geography as in history; but in neither subject should it involve a sacrifice of truth and efficiency to form and sound. The degree of technicality appropriate in a geographical description will depend largely on the condition of the readers for whom it is written. As the description here in discussion is intended for mature geographers, it does not seem to be either unduly technical or unattractively awkward.

It is assumed at the beginning of the description that Apennines and Adriatic are names that every mature geographical reader will know without explanation. No other local names are used in the general physiographic description. But now that the general features of the district have been presented, local names and all sorts of details may be conveniently added, and ontographic relations may be effectively introduced. For example, agricultural villages are found on the broader hills of the dissected interfluves, one of these being Loreto with its famous shrine, standing on a full-bodied spur crest some four kilometers back from the coast; here pilgrims would appear to yield a larger revenue than farms. Fishing villages lie on the harborless strandplain, especially near the mouths of the larger valleys; in bad weather their boats are hauled up on the beach or towed into the little rivers. An important trunk railroad and a main wagon road follow the level strandplain for a long distance; branch railroads enter some of the larger valleys, and wagon roads turn up all of them; while roads of less importance enter certain smaller valleys and sidle in zigzags up the spurs to the farming villages on the interfluve hills, or follow the hill crests in passing from one upland village to another. It may be pointed out that Ancona does not belong to the coastal plain; it lies on the northern side of a cliffed promontory of altogether different constitution.

The Valley of the Lamone

Our second stop was at Faenza, where the valley of the Lamone was examined. It is the work of one of the many streams that extend in apparently consequent fashion from the northeastern flanks of the Apennines across a piedmont lower land, to the fluviatile

plain of the Po, which here replaces the Adriatic sea. This late mature valley, enclosed by well dissected uplands of moderate relief, is of particular interest in having an early mature valley of small depth eroded in its floor: that is, we have here the late mature work of an earlier cycle followed by the early mature work of a later cycle; the earlier cycle having been interrupted and the later one introduced by a gentle uplift. I was greatly impressed by the distinctness of these combined features during the trip by rail from Faenza to Florence in 1899, and then resolved to examine them more at leisure at some later season. On going there in 1908 we were well rewarded by a delightful prospect over the valley from a favorable view point up on its western side, where our small party of four spent some profitable and memorable hours in the shade of a group of tall cypresses alongside of a little chapel, sketching, drawing maps and diagrams,

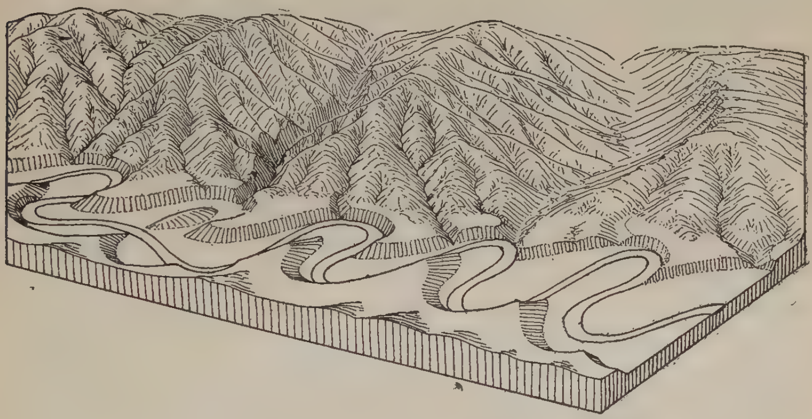

FIG. 3.
Diagram of the compound valley of the Lamone, Italy; looking West.

and discussing our efforts at systematic description. Then we walked over some of the neighboring hills, and in the afternoon went by train a short distance farther up the valley for new observations. The results are summarized in Fig. 3, an imagined bird's-eye view, looking northwest.

We thus learned that the valley traverses two piedmont belts of unlike constitution; an inner belt of deformed and somewhat resistant strata, which trend in general parallel to the extension of the mountains in the background; and an outer belt of weak, bedded clays, dipping gently northeastward. The inner belt seemed to represent the well degraded border of the Apennine oldland, with re-

spect to which the outer belt had been deposited; and the outer belt was apparently a continuation of the dissected coastal plain that we had seen by Ancona, here descending by straggling hills to the plain of the Po, instead of ending in an evenly retrograded line of sea cliffs. We noted first that in the inner belt of stronger strata the new, early mature valley, incised in the gravel covered floor of the former, late mature valley, has a well defined meandering course, with steep-walled amphitheaters in which the inclined strata of the district are well exposed, with sloping spurs sharply trimmed on their up-valley side, and with graceful flood-plain scrolls, systematically placed along the down-valley side of the trimmed spurs. The depth and breadth of the new valley both decrease up-stream, as if the work of the new cycle were less and less advanced as the mountains are entered. As might be expected, the small lateral streams that come down from the dissected uplands have as yet eroded only eroded narrow, young, steep-walled gorges, with abundant outcrops, beneath the soil-covered slopes of the mature lateral valleys of the earlier cycle; but the lateral gorges are already worn deep enough to mouthe at grade in the main valley. We noted secondly that, in the outer belt of weaker strata, all the features are farther advanced in erosional development, and that at the same time the depth of erosion decreases down-stream. The main valley of the first cycle was here widely opened; the main valley of the second cycle, originally a narrow, incised meandering valley, has now reached the stage of nearly consumed, blunted spurs, so that in this stretch the Lamone wanders freely on a flood plain of greater breadth than that of its meander belt. The valley sides of the lateral streams are here in large part already regraded with respect to the new depth that the valleys have gained; but in consequence of the faint northeastward dip of the weak clays, the higher part of the lateral valley sides are often incompletely graded on the northeastern or outcrop slope, and there exhibit a minute, bad-land dissection; while the southwestern or basset slope of the valley sides is smoothly sloping. As the hills decrease in height towards the plain of the Po, the height of the terrace remnants of the earlier valley floor over the newer valley also decreases; and the hills and the terraces vanish together at the border of the fluviatile plain. All this permits one to make a somewhat more definite statement regarding the uplift by which the first cycle of erosion was interrupted and the second introduced; namely, that the uplift seems to have been greater toward the mountains in the background than toward the

plain in the foreground; hence, that it apparently involved a gentle northeastward tilting, such as had been inferred near Ancona. But let it be added at once that the geographer's interest in these inferences as to past uplifts of the Apennines does not spring from any concern on his part as to past events as such, but goes only so far as past events may aid him in the appreciative observation and the effective description of existing land forms.

A railroad and a main highway follow the western terrace remnant of the earlier valley floor; hence they have to cross the newly incised side-valleys on embankments and bridges. I believe a few small villages lie on the broad floor of the newer valley in the outer belt of weak clays; but in the inner belt of stronger structures, all the villages are on the terrace; the newer valley being too narrow for occupation. On the western terrace near the junction of the two belts lies the village of Brisighella; it was by the chapel just above the village that we spent our morning hours, sketching and writing; and I can strongly recommend this spot as the goal of a physiographic pilgrimage for all who choose to follow.

Thus I might go on describing the smooth-floored basin of Florence, in contrast to the maturely dissected basin of Val d'Arno; the young lowland and its simple shoreline of elevation and progradation north of Leghorn, in contrast to the complicated mountainous shoreline of the Riviera Levante, with its interesting features due to slight and recent uplift towards Genoa, and corresponding depression towards Spezia; an account of this delightful district was presented to the research department of the Royal Geographical Society in March, 1909; it has since then been published in a paper on "The Systematic Description of Land Forms" (Geographical Journal, September, 1909, 300-318). Much might be said of the maturely established elbow of capture of the Tanaro at Bra; of the superb exhibitions of glacial erosion in the overdeepened troughs of the Alpine valleys, whose terminal basins hold Lakes Como and Maggiore, and of the remarkable pair of glacial distributaries by which the irregular intermediate basin of Lake Lugano was excavated; and so on. It was much to our regret that while the excursion was in the district of the sub-Alpine lakes, where the party had reached nearly a dozen, no member could from conviction present the arguments of the anti-glacial erosionists. We did the best we could in their absence, but found it impossible to explain the oversteepened trough walls and the numerous hanging lateral valleys of most typical development without accepting a strong measure for

glacial erosion. After crossing into France, two professors from the Universities of Grenoble and Fribourg presented their views against wholesale glacial erosion during a visit to the strongly glaciated valley of the Romanche; but it seemed to most of us that their discussion was incomplete and unconvincing.

What with the variety of landscape that we studied and with the variety of training represented in our cosmopolitan party, it will, I think, be agreed that our discussions as to methods of describing land forms must have been profitably extended by the time the excursion closed in the volcanic district of central France. Without giving further account of our results, let me next present certain underlying principles, which appear to me of much importance in this connection.

Description in Terms of Type Forms

Whenever an observer attempts to tell what he has seen, so that a landscape or a region may be conceived by his readers, he must describe the observed forms in terms of certain similar forms previously known to him, and hopefully known also to those for whom he writes. It must always be in terms of something previously known that a verbal description is phrased. Hence the most accurate verbal description will be made by that observer who is equipped with the largest variety of previously known type forms. It is important to consider how a young geographer is to obtain such an equipment. The ideally perfect method would be for him to travel about the world and see with his own eyes a great variety of actual forms, from which he might gradually develop a complete series of type forms. Then all other forms could afterwards be described in terms of these types. But this method is manifestly impossible of general application. Some equipment of types may be secured by observation of actual forms; and this beginning may be significantly enlarged by the study of descriptions, pictures, models, and maps of actual forms, as prepared by other observers.

The geographer who follows the empirical method stops here. The geographer who follows the explanatory method goes much farther. He extends and systematizes the equipment, thus far gained, by deducing many related forms; and thus fills his mind with a series of more or less ideal forms. It will then be chiefly in terms of the ideal types, largely developed by deduction, familiarized by diagrams, and confirmed or corrected by experience, that his explanatory descriptions of actual landscapes will be phrased. But

whether the geographer follow the empirical or the rational method, it will be only in proportion to the completeness with which his series of ideal forms provides him with counterparts of actual forms, that his descriptions of actual landscapes can be true to nature. Only in proportion to the compactness of the terminology in which the ideal forms are verbally expressed, can the observer's descriptions be tersely stated. Only in proportion to the correspondence existing between the ideal forms as conceived and named by the observer and by his reader, will the reader be able to apprehend the observer's meaning.

Imagine, for a moment that the observer had no mental conception corresponding to what is commonly understood by the word, hill. He would then have to fall back on geometrical terms, such as apex, slope, base, and so on, in order to give an account of a hill when he sees one; and his account would involve awkwardly long paraphrases. Or imagine that when the observer writes down the term, hill, the reader conceives the form that we usually mean by the term, hollow. The reader might mentally conceive a very definite landscape; but it would have little relation to the landscape that the observer had seen.

Contrasts of Empirical and Explanatory Methods

Let me contrast somewhat further the empirical and the rational use of type forms. In so far as ideal forms or types, with their corresponding terms, are learned partly from direct observation, partly from books and maps and pictures, they may be treated either empirically or rationally. If treated empirically, each type form, however learned by the student, must have been derived from someone's observational experience, without explanatory interpretation. If treated in the explanatory fashion, all the members of the series that are based on induction should be rationally or genetically accounted for as far as possible; while many other members, developed by deduction, will be perfectly understood, even though they are purely imaginary. Under the empirical method, diagrams are unsafe if they depart from the forms of nature, for their departures can hardly be reasonable under a method from which reason is excluded. In support of this strong statement, one need only turn to those fanciful not to say fantastic landscapes, which have so often defaced the pages of empirical text books, and which bring together in the most absurd manner all sorts of incongruous land forms. Under the rational method, diagrams and especially block-

diagrams, of which more will be said below, are of immense service; they present the graphic equivalent of deduced forms, whereby another person than the deducer may easily apprehend the intended meaning; and they serve at the same time as graphic definitions of a systematic terminology.

Furthermore, each member of the empirical series must be learned without consideration of its origin and without explanation of its relation to other forms. Hence to the geographer who employs the empirical series, the corresponding actual forms in a landscape will seem to stand in purely arbitrary association with one another; the occurrence of one element of form cannot be logically taken to indicate the associated occurrence of another element; the use of empirical types in the description of actual landscapes or regions requires that every part must be described for itself. On the other hand, all the types in an explanatory series, and particularly the deduced types, are learned in view of their origin by the action of some reasonable process on some specified structure through some limited period of time; and hence type-forms of this kind are necessarily considered in relation to their natural associates. The association may be regional, as in the case of the different parts of an ideal landscape produced by the imaginary action of process on structure to a given stage of development; or the association may be sequential, as in the case of a single element of form followed in imagination through its successive stages of erosional change, from the initial, past the sequential to the ultimate.

As a further contrast, all the many members of an extended empirical series of ideal types must be learned arbitrarily and separately, for no mnemonic aid from explanation attaches to any of them. All the members of an extended explanatory series may be divided into groups, so that the groups themselves shall have certain highly suggestive general relationships, and so that the members of each group shall be regarded as systematically interdependent and easily remembered. The development of the explanatory series is immensely aided by the mental process of deduction, which may be carried on by a trained student anywhere and at any time at his convenience; but deduction has no significant place in the preparation of the empirical series, each member of which must originally be learned by some observer travelling about in the actual world.

Having now pointed out the strong contrasts between these two kinds of type forms, in terms of which the descriptions of natural landscapes and regions must be made, let me hasten to state that

no one to-day uses either kind in its purity. The most conservative empiricist will introduce some explanatory types and terms in connection with forms of which the origin is manifest, such as sand dunes, deltas, volcanoes, and sea cliffs; while the most determined rationalist will not infrequently find certain actual features which he cannot explain, and for which he can therefore establish no corresponding explanatory types. The difference between the empiricist and the rationalist is therefore not so much in their practice as in their intention. The empiricist introduces explanatory terms as it were by accident; he makes no conscious effort to substitute explanatory types for empirical types, and he has no definite intention of introducing explanation as the most effective means of description. The rationalist, on the other hand, consciously and intentionally strives to find out the origin of every form that he observes, and then tries to describe every observed form systematically in terms of deductively developed type forms. The conservative empiricist condemns the bold rationalist as using a dangerous method, in that it must often be unsafe to describe what one sees in terms of what one does not and cannot see; and in that it is unwisely venturesome to introduce theoretical considerations, which are in many cases necessarily more or less doubtful, instead of holding to direct observation which is essentially safe. The venturesome rationalist criticizes the hesitating empiricist as using a blind method, in that it is short-sighted to describe only those things which can be seen with the outer eyes, and unreasonable to omit all those illuminating explanatory considerations, theoretical though they be, by which so much light is thrown on empirical facts, and by which the way is indicated to many facts which the empiricist overlooks.

My own preference for the explanatory method is so strong that the preceding paragraphs have probably done some injustice to the empirical method. Be this as it may, it seems to me a plain duty to use to the utmost every explanatory relation that we can discover, in so far as it aids us in describing existing landscapes. If the explanation seems assured, it may be used without qualification; if it appears somewhat venturesome, explicit notice may be given of its insecurity by introducing warning words; for example, "as if." The extraordinary advances made in the understanding of the evolution of land forms in the last half century, particularly those advances made by our government geological surveyors in the arid southwestern part of our country, cannot be neglected by the geographers of this new century. The only matter that is questionable

is the manner in which the advances shall be practically applied in geographical investigation.

Geology, as Such, to be Avoided in Geographical Descriptions

The influence of geology upon geography has indeed been so great that it has come to be a common practice to introduce some statement of geological history, as if in explanation of the origin of land forms, so as to aid in their description; but if geological history is introduced in a more or less haphazard way, it often goes too far in taking the attention away from the geographical present and holding it too long on the irrelevant past; and it often does not go far enough in the way of emphasizing the origin of visible forms. The accidental geological explanation is moreover especially deficient in not developing a carefully extended series of deductive types, in terms of which existing forms may be presented. In some way or other such a series of types certainly ought to be developed and carried in the mind as an indispensable equipment for outdoor observation and description. The way that has been most convenient, effective and helpful in my experience is the one embodied in the method to which I have given the name "structure, process and stage," and of which some illustration has been afforded by the examples presented above from my Italian excursion.

The Scale of Verbal Description

There are certain supplementary considerations regarding the description of land forms to which brief attention may be given. The first concerns what may be called the scale of verbal description, and corresponds to what we familiarly understand by the scale of a map. The well-trained cartographer has had conscious practice in the reduction of large-scale maps to small scale, and knows that in so doing he must intelligently and critically select the major features for retention and the minor features for omission; he knows also that a really good small-scale map can be made only by reducing it from a well prepared map of larger scale. What I wish to point out here is that the principle of large and small scales may be applied not only to maps, but to verbal descriptions as well. The kind of maps here considered are not those sketch maps of hasty route surveys, in which large spaces are necessarily left blanks; these would correspond to the verbal reports of hurried excursions, in which the writer is well aware that his records are deficient in many respects. It is here a question of more thorough work; that is, of

maps for which all necessary surveys have been made, and of descriptions for which all necessary studies have been completed. Then, just as a cartographer must intelligently select certain features to be retained in reducing a large scale map to a smaller scale, so a geographer, who has already gained sufficient information about a district to complete an elaborate or large-scale description of it, must critically select the major features for retention and the minor features for omission, in compressing his account to the space of small-scale presentation.

In view of this principle, the geographer who wishes to make a well-considered, brief statement concerning a district or region must first learn a good deal more about it than can be contained in a little space. He must then intelligently and critically select the major features for retention and the minor features for omission. He must furthermore carefully study the capacity and the limitations of verbal description, and thus come to perceive that his task in setting forth the features of a district in words is altogether different from that of the cartographer in setting forth the facts graphically. Cartographic representation permits, and indeed requires, the indication of every element of form that is reached by its scale, and gives to each element a definite location and dimension. Hence the cartographic representation of geographical features is very definite. The eye, when first looking over a map, glances from part to part, and apprehends chiefly those elements which by repeated occurrence give character to the district, and those which by reason of exceptional peculiarities stand forth from the others; afterwards, special parts of the map may be more closely examined. On the other hand, verbal description can hardly be understood unless the reader follows the order of presentation chosen by the writer. The description will be fatiguing if it attempts to state the location and size of every element of form; it is therefore best employed to state the generalized characteristics which the eye would perceive in looking over a map, thus giving first emphasis to prevailing features, and only secondary emphasis to less important special features. After the leading facts are thus presented, more elaborate description may well follow, with due attention to what may be called "local color."

Inasmuch as verbal presentation is necessarily linear, one item following another, emphasis is automatically given to those which come first; subordinate rank is indicated for such items as are assigned a later place; but on a map there is no beginning or end; the whole surface is presented simultaneously, and the student may

first take up any part he pleases. If any one wishes to learn minute details as to the length or direction of certain small streams, the location and altitude of hills, and so on, he can best find them on a map; but if he wants a well-phrased characterization of a district, he will be best helped by a verbal description, on a scale appropriate to the occasion. Hence the importance of giving conscious practice to the preparation of verbal descriptions of a given district or region on different scales; one might be ten lines long; another, might fill a page; a third, a chapter; a fourth, a volume. A geographer who proposes to make himself proficient in his science ought to practice himself as thoroughly in descriptions on different verbal scales as in drawing maps on different graphic scales.

The Style of Verbal Description

Maps differ in style as well as in scale. A wall map on a given scale is coarse-textured, so that certain leading features may be seen across a room. A map of the same region, and on the same scale, divided into sheets and bound in an atlas for library use, is crowded with minute details of fine texture. So verbal descriptions may vary in style as well as in scale. For example: the first account of the dissected coastal plain on the Adriatic border of Italy may be regarded as of medium scale and of technical style; the several following paragraphs, in which the same ideas are presented in more general language, is on larger scale, so far as space is concerned, but as it is of popular rather than of technical style, it really adds no new facts, nothing but ease of apprehension to the smaller scale description; hence it may be compared to a wall map, in being offered to ready understanding. On the other hand, if the increased space had been given to a continuation of the technical description for the purpose of bringing in many details, the larger scale of description might then be compared to a larger scale of a map for library use, in which many small features are indicated. Hence style as well as scale requires consideration; and in acquiring the art of geographical description, conscious experiment and practice should be given to various styles as well as to various scales.

From all this it must appear clearly enough that the preparation of an effective verbal description, after all necessary field studies have been made, will require the careful consideration of several different points. The style to be adopted should be first determined according to whether the description shall be technical, for trained geographers, or popular, for intelligent, mature, non-technical readers.

Second, consideration must be given to the scale or space permissible, according to the opportunity for publication, and to the relation which the description bears to the rest of the volume in which it may be only a part. In view of the style and the scale as thus determined, the critical selection of certain items to be included and of others to be excluded may come next; and with this should go the careful determination of the order in which the included items shall be presented. It has already been shown that various items concerning location, dimension, attitude and direction of subordinate features had best be omitted from verbal descriptions, they have their better place on a map; if included even in a large-scale verbal description of technical style, they will make it unreadable. It is chiefly the generalized treatment of dominant or of recurrent elements that deserve verbal statement; with subordinate place for the more significant exceptional features.

The Order of Presentation

As to order of presentation, a whole essay might be written. I shall here emphasize only certain leading principles. The first is, to present the main idea in the first sentence; to give at once, at the very outset, a general block-statement for the district concerned. The reader will then most promptly apprehend its general nature, most easily follow the explanatory paragraphs as they are expanded, and most readily appreciate subordinate features, item by item, as they are introduced in orderly advance. The case is utterly different from that of a novel or a play, in which it is appropriate enough to conceal the plot till the end is approached; here the reader or listener enjoys being kept in the dark while the story is developed. But in a scientific essay, the reader ought, contrary to common practice, to be made aware of the end at the beginning, particularly if the explanatory method of description is employed; so that as the description advances, the leading explanatory ideas as stated in the first paragraph may be constantly confronted with the evidence that bears upon them, and so that the smaller features may be immediately placed in their proper position with respect to the general scheme. Narrative descriptions, in which items are presented in the order of encounter in the field, may be appropriate as a means of recording the work of hasty reconnoissances, but when the narrative method is employed in the presentation of more careful studies, the most that can be said of it is that, as far as scientific geography is concerned, it is a very unambitious method.

It has already been pointed out that the location of natural features should not be indicated by means of their relation to small artificial features, such as little villages, which must be unknown to most readers; but on the contrary, that small artificial features, such as little villages, ought to be located in relation to the previously described natural features, to which they stand in some reasonable relation. This principle should surely be carried out by those who believe that the location of artificial features exhibits some response to physiographic environment. Likewise, an individual hill or stream should not be first indicated by its name, which is the least natural thing about it, and which is unknown to the reader and therefore of no assistance to him in his reading. Such features should be introduced in general terms, by describing the whole group of features to which they belong, and then singling out such members of the group for location and name as may be desired.

It is of prime importance to the writer to test his own description as he prepares it; to determine whether his manner of announcing the most general features is thoroughly effective; whether the order in which he introduces secondary and tertiary items is the most appropriate. Practice added to close scrutiny can alone develop proficiency. On the other hand, when a carefully prepared description reaches the reader, he must exercise a considerable degree of attention and skill, in order to apprehend the full significance of the writer's terse phrases; and he must use a skilful imagination in the process of visualizing the forms, large and small, as they are introduced by the writer. Here again, nothing but practice can produce proficiency; and all this suggests that the training of a would-be geographer ought to include conscious, well-planned exercises in all these processes of observing, generalizing, writing, reading, and visualizing, just as surely as it should include exercises in surveying and map-drawing.

Graphic Aids in Geographical Description

The best geographical descriptions fall short of satisfying the reader if they are purely verbal; they ought to be supplemented by graphic devices wherever possible. A small scale map may be introduced to great advantage on an early page, in order to exhibit general locations; hence, well known as Italy may be, the places above mentioned in connection with my Italian excursion are probably identified more easily and more promptly than they would be otherwise, by means of the outline map, Fig. 1, prepared in an

hour, here reduced to half scale, on which our route may be followed and on which the Ancona district and the valley of the Lamone, above Faenza, may be quickly found. A larger scale map, if available, may be appropriately provided to accompany more detailed descriptions; a good purpose is served in this respect by the elaborate sheets of the Italian topographical map, 1:100,000, already mentioned, which clearly exhibit the mature dissection and the even truncation of the coastal plain, south of Ancona, and the strand plain by which the former sea cliffs are now separated from the shore line. Photographs and sketches serve to illuminate the text; but in recent years photographs have been rather recklessly used, particularly when they are printed in a very blurred condition on rough paper. Sketches are in many cases more serviceable, even though less accurate, than photographs, because they show what the observer wishes them to show. As a subordinate matter, let me add in this connection certain details that are often overlooked, if one may judge by many illustrations in scientific journals. First, the size of the page on which a figure is to be printed ought to be learned before the figure is drawn. Decision should then be made as to whether the figure shall occupy the whole breadth of the page or only half-breadth; and to do this it is worth while to sketch the figure roughly on the scale that it will have in the text. When this is settled, the figure should be redrawn on double scale with really black ink in smooth firm lines, so that it may be effectively reduced in making a black and white "process" cut. If any lettering is included, let the letters be plain and unshaded; and let them be large enough, so that when reduced they are easily read. The number and title of the figure ought not to be drawn on it or below it; both can be set up in type, when the figure is printed in its proper place in the text, thus saving in time and gaining in appearance. These are trifles: but trifles ought to be properly attended to, and not neglected.

In addition to the various cartographic and pictorial aids thus far mentioned, let me call special attention to the device known as block diagrams, or bird's eye views, such as Figs. 2 and 3, which may be designed so as to form useful supplements to descriptions that open with condensed block statements. Both tell the plot of the whole story at the beginning, and thus allow the reader to place all details where they belong, when they are met in later paragraphs. Just as block diagrams aid in giving graphic illustration to the members of series of deduced type forms, as has already been mentioned, so they aid in the understanding the description of actual regions,

because they serve so immediately to present the generalized type forms with which the observer compares the actual forms. When seen corner-wise, block diagrams have the advantage of presenting two structural sections, if desired, in immediate association with the surface forms that have been carved on the structural mass. When drawn in groups, they have the further advantage of compressing into a single view the several successive stages of development, which are verbally presented or implied in the statement of the text.

Diagrams of this kind are not and are not meant to be mere pictures of observed landscapes, for they must always be simplified by the judicious omission of much unessential detail, and greatly compressed by the omission of many repetitions of similar elements. They should be simply drawn so as not to demand too much time in preparation, yet they may still be vivid and effective in aiding the reader to grasp the meaning of the writer.

No one may be more conscious of the defects of diagrams than the one who has drawn them. In the fancy view of the dissected coastal plain south of Ancona, here given in Fig. 2, the hill shading is very rough; all the slopes are drawn convex, and hence fail to show the graceful concave lower sweep down to the valley floors. The terraces in the main valleys and the narrow belt of oldland included in the background are too definite and distinct. The absence of all indications of forests and fields, of villages and roads, gives an impression of barrenness and vacancy that does no justice to the pleasing reality. Moreover, the dissected hills and the broad valleys of two extended consequent streams from the oldland do not correspond to any particular hills and valleys of the district concerned; they merely show the observer's generalized idea of the kinds of hills and valleys that characterize the district. Nevertheless the drawing has a value in immediately presenting the essential features of a late maturely dissected plain, in which the streams and valleys are prevailing consequent, with some insequent branches; in which the hill sides are all reduced to gently graded slopes; and in which the spurs in the foreground are all evenly truncated by the former sea cliff, in front of which the strand plain is now prograded.

Similarly the fancy sketch given in Fig. 3 shows only the kinds of features that were noted in the valley of the Lamone:—the maturely dissected hills developed on the more resistant structures that occupy the middle and left of the view; the incised meandering valley of the second cycle, maturely opened beneath the floor of the

broader, late mature valley of the first cycle; the sharp-cut side gorge through the hills of harder structure in the left-center, in contrast to the wider side valley on the right, where the weaker clays of the dissected coastal plain replace the more resistant strata of the Apennine foot hills; and in immediate association therewith the greatly broadened floor of the main stream after it passes from the more resistant into the less resistant structures. The diagram would surely be much more faithful, if it had been drawn from a hilltop on the near side of the valley instead of from the imagination of what such a hilltop view would be. Many of the lines would be smoother and steadier, if they had been drawn by a professional draftsman; but diagrams prepared by some one else than the observer are hardly more satisfactory than lectures prepared by an expert type-writer instead of by the lecturer himself.

Block diagrams are more immediately understood than maps are; they are vastly superior to mere profiles, which of all graphic devices are of least value to the geographer; for he is concerned with surfaces, not with lines; yet if profiles are wanted, they are found along the side of block diagrams, in their proper position with respect to the adjoining surface. For the purpose here indicated—that of giving an immediate introduction to the whole story—block diagrams are as much more serviceable than photographs, as photographs are more serviceable than block diagrams when it comes, later, to the presentation of details. One of the chief values of block diagrams remains to be mentioned; they can be drawn from any desired point of view, as in the case of Figs. 2 and 3, so as to show the features represented in the best possible relation to each other. Some ingenuity in the way of inventing and designing is here called for; and it is well expended if the final diagram is thereby drawn in the most effective manner.

An objection that is often raised against the use of block diagrams—that their preparation demands a knowledge of drawing—ought to have small weight among practical geographers, especially among the younger ones. To object to an effective kind of diagrams because their preparation demands a moderate skill in drawing, is like objecting to horseback riding during a geographical excursion in the West because it involves a little skill in the saddle; or to the use of original photographs as illustrations, because their preparation requires a little acquaintance with cameras and films; or to the consultation of European journals, because this calls for a moderate knowledge of foreign languages; or to map-making, be-

cause it depends on an elementary understanding of cartography; or to preparing a written report, because it involves a knowledge of composition. There must of course always be a great difference in the proficiency that different geographers will reach in these several associated arts; but any one who is in earnest in his work may soon acquire a profitable reading knowledge of a foreign language or two, or a sufficient comfort in horseback travel, or a simple proficiency in photography, or a reasonable expertness in writing reports on various scales and in various styles, and also a helpful handiness in drawing diagrams. The only serious point here to be settled by a practical geographer is: are diagrams, foreign languages, photography, and riding, and so on, really helpful in the kind of work that he proposes to undertake; if they are, then he will as a matter of course set about acquiring some degree of skill in each and all of them.

Objections to the Method of Structure, Process and Stage

Allow me briefly to consider some of the objections that have been urged against the method of structure, process and stage in the description of land forms. A German geographer has regarded that part of the method which involves the scheme of the cycle of erosion as too rigid, and has likened its use in the description of natural landscapes to the cramping of nature in a strait-jacket. Such a criticism only indicates the complete failure of the critic to apprehend the method; for it is essentially elastic and adaptable; much more so, I believe, than any other method of description that has been formulated.

Some other critics have regarded the method as too geological, because it requires the consideration of underground structures and of past processes. This it certainly does require; nevertheless it introduces underground structures only so far as they aid in the appreciation of visible surface forms; and it introduces past processes only in so far as they aid in the explanatory description of actual surface features. In this respect, it is interesting to note that, judging by my experience in Germany last winter (1908-'09), the method of structure, process and stage is much less geological than the method of geographical description commonly employed by the younger geographers at the University of Berlin; for they habitually presented past geological conditions and processes as such, and treated them as characteristic parts of geographical reports, even though the events thus brought in from the past bore in no direct or

helpful way on the features of the present. Many interesting discussions were held on this point, always with the object of trying to emphasize the existing visible landscape as the object of a geographer's work, and hence with the wish to exclude every geological item, however interesting in itself, if it had no helpful bearing on the observable facts of to-day. For example, I questioned the value of the geological term, Triassic, in the account of a certain district in Hesse; my contention being that all a geographer's needs were satisfied when the composition, structure, thickness and attitude of the formation concerned were stated, without regard to its date; but German geographers seemed to be in favor of including the names of geological formations in geographical descriptions. The geologist of course wishes to know the date of origin, as well as the present structure and attitude of the formations that make up a district; but the geographer has little or no need of such historical information, although it is extremely important for him to know to what stage of erosion the district concerned has advanced in one or in several successive partial cycles. However, this is a subordinate matter.

An English geographer has expressed some doubt as to whether the method of structure, process and stage, which he recognizes to be of value for the description of small districts, will prove serviceable for the description of large regions. My own opinion on this point is that its value for large regions can only be determined by experiment, which I should like very much to see tried. In any case, we can gain no comprehension of large regions save by gathering and by generalizing observations of small visible landscapes. It is fair to expect that the better our understanding of detailed morphology, the better we can summarize general feaures. My own experience in describing the larger subdivisions of the United States and of Europe would encourage me to say that the explanatory method can be well used for the treatment of such areas; but I have made few systematic experiments with any other method of description.

Another geographer has expressed his fear that an explanatory method of description for land forms will prove dangerous in the hands of untrained students, and that young disciples may apply it in a way that will cause anxiety at first and horror afterwards. Horror is rather a strong word to use in this connection; but I can instance several examples that have caused me some anxiety, and others which have, I am sorry to admit, shocked me to say the least.

There is the case, for example, of a geographer who, inasmuch as he submitted an article to me for criticism, may perhaps be regarded as a disciple to a small extent; but surely he caused me some anxiety by stating in essence that "granitic districts are of rugged form." His evident error here was the failure to consider the erosional process and the time element, or stage of erosional development, in his partly explanatory treatment; for resistant as granite is, rugged as its forms may be in a youthful stage of normal erosion, and sharp as they may be in a mature stage of glacial erosion, granite must have subdued and rounded forms in late maturity; and like every other kind of rock, even the hardest granite must be worn down to low relief of very tame expression in old age, as abundant examples testify.

In another case a geographer who explicitly declared himself to be my disciple shocked me by the additional declaration that the scheme of the cycle of erosion, which is essentially involved in the method of structure, process and stage, must be inapplicable to districts in which frequent movements have taken place, because forsooth he thought that the scheme of the cycle could be used only where complete cycles ran their course! In both these cases and in various others of a similar kind, criticism ought not to be directed against the explanatory method of description, but against its wrong use. It is proverbial that "a little learning is a dangerous thing"; the proper guard against such danger is better found by decreasing the careless use of an explanatory method, rather than by discouraging its careful development.

And finally, to close these comments with one that suggests a most peculiar attitude on the part of the critic, it has been objected that the method of structure, process and stage cannot be applied until one knows all about the district that he is describing. In so far as the use of the method may require an observer to make a serious study of a district before he attempts to tell about it, the method is thereby recommended; but as a matter of actual experience, the explanatory method has proved useful even in the most hasty reconnoisance, because it aids so greatly in directing observation to significant points, which might as likely as not escape the attention of a blind empiricist.

The kind of criticism that the method of structure, process and stage really needs is, as has already been intimidated, criticism based on the experimental and comparative use of various methods, each method being first carefully thought out, and then all the methods

being thoroughly and impartially applied to one and the same district. Experiment of this kind should of course be made by various observers of different trainings and preferences, and in different localities. Precisely this sort of experimental criticism was attempted during the Italian excursion of 1908, but under conditions, as already pointed out, that predisposed the jurors to a verdict in favor of a particular method. It would be a good thing for geographical progress if a larger experiment of the same kind could be made. I trust that our Association may some day actively engage in such an enterprise.

THE NEW BOUNDARY BETWEEN BOLIVIA AND PERU

(Map opposite p. 436.)

Another of the boundary disputes which, from time to time, have severally strained, if not dissolved, the friendly relations between various South American countries, has at last been settled. A number of maps drawn to show the new boundary between Bolivia and Peru, according to the treaty of La Paz, signed on Sept. 17 last, were prepared before the exact wording of the treaty had been received in Europe and are therefore not entirely accurate. The accompanying map, prepared for the *Bulletin,* has been compiled in accordance with the letter of the treaty, and with the aid of official map material supplied by the Consul General of Bolivia in New York and other data used to present the geographical features of the region as accurately as can be done in the present state of the surveys.

One of the red symbols shows the southern boundary of Brazil, in this region, according to the treaty of Petropolis. It will be remembered that a considerable number of Brazilian rubber collectors and others who had settled in the basin of the Rio Acre, attempted to establish the Republic of Acre in 1902, an act that Bolivia resented, for she claimed, though she did not adequately control, this remote district. Out of this trouble, there was finally evolved the treaty of Petropolis under which Bolivia ceded about 27,500 square miles of the Acre region to Brazil in return for $10,000,000 and some other considerations. Major P. H. Fawcett was engaged to delimit this new boundary, in behalf of Bolivia. He began the work in 1906

and his incidental explorations and the formidable obstacles he encountered are described by him in the *Geographical Journal* for May, 1910.

Bolivia's boundary disputes with Brazil were at length out of the way but there remained serious differences with Peru concerning their frontier. The Argentine Government was agreed upon as the arbitrator of this dispute and the Argentine President announced the decision of the Commission, in July last year. Our map shows the line which was thus proposed as the boundary between the two countries.

But Bolivia declined to accept the boundary thus marked out. She contended that the Argentine Commission had not taken the time necessary for a careful examination of the arguments of the disputing nations. It was asserted that historical facts had been ignored and that a large area which Bolivia had discovered, and partly explored, in which she had established industrial enterprises and which she had officially occupied along the rivers Inambari, Tambopata and Heath was, according to the Argentine arbitration, to be turned over to Peru. Bolivia declined to accept the suggestion of the Argentine Commission which she recognized only as having advisory relations concerning the controversy between the two powers. The reasons why Bolivia declined to accept the Argentine arbitration were set forth in English by Señor B. Saavedra, Legal Adviser for Bolivia in the arbitration, and printed by the government at La Paz under the title of "The Argentine Award."

Negotiations were immediately opened between Peru and Bolivia to see if it were not possible for them to settle the controversy themselves. These efforts fortunately succeeded and the two countries agreed upon the boundary between their respective territories in the disputed region, which is wholly to the north of 15° S. Lat. The unbroken red line on the map shows the boundary between Bolivia and Peru according to the treaty between the two countries signed at La Paz. The following is a translation of that part of the treaty describing the new boundary.

"The line of demarcation between the territories of Bolivia and Peru starts where the actual, accepted boundary begins to coincide with the Rio Suches. It crosses the lake of the same name and extends over the hills Palumani Tranca, Palumani Kunca, the Peak Palumani and the Cordilleras de Yagua Yagua. From this point, the boundary line extends through the Cordilleras of Huajra, Lurini and Ichicorpa, following the mountain range which divides the

waters of the Rio Lanza and the Rio Tambopata, until it reaches 14° South Latitude. From this point, it advances east along the same parallel to the Rio Mosoj Huaico or Lanza, which river it follows to its confluence with the Rio Tambopata.

"From the confluence of the Rio Tambopata and the Rio Lanza the boundary line extends to the western headwaters of the Rio Heath and follows this river to the Rio Amaru Mayu or Madre de Dios.

"From the confluence of the Rio Heath and the Rio Madre de Dios, a geodetic line will be drawn, which will start at the mouth of the Rio Heath and pass west of the barraca Illampu, across the Rio Manuripi (leaving Illampu a Bolivian possession), to the confluence of the Arroyo Yaveriji with the Rio Acre; leaving all the territory east of this line to Bolivia and the territory west of this line to Peru."

It is seen that each of the powers retains the territory which was mutually recognized as belonging to each before the award was made. In the south, a comparatively narrow territory is given to Peru which the Argentine Award had conceded to Bolivia. In the middle part of the boundary, the line marked by the Argentine Commission is adopted. In the northern part, a very large territory is given to Bolivia which the Argentine Award apportioned to Peru.

The northern area that is now indisputably Bolivian has large resources in rubber and other tropical products but, as yet, has a very small white population. On the other hand, there are a number of Bolivian settlements, with considerable business interests, on the Peruvian side of the boundary.

By mutual concessions, the two nations have reached an amicable settlement of their boundary difficulties and have supplied a precedent that may advantageously be kept in view by other Latin American republics in the adjustment of frontier questions.

THE GREAT WALL OF CHINA*

The journey up the Chinese coast in clear, mild weather around the Shantung Peninsula, with its bold mountain coasts, is an interesting trip, and gives an easy opportunity to visit the German colony at Tsing-tau, and the eastern end of the Great Wall.

It has become the fashion to speak slightingly of the wall, as a waste of human energy, as an absurd attempt to keep out armies by the sight of a parapet. Travellers, geographers, and military men have jeered at a fortification 2,000 miles long, carried over the summits of inaccessible mountains. A day on the end of the wall at Shan-hai-kwan brings doubt upon these criticisms. The wall was intended for protection against the fearful scourge of Mongol horsemen, who swept down from the north and west, just as their first cousins, the Turks, harried the frontiers of the Greek Empire. Their tactics were a swoop, a dash, and a retreat; they had neither time nor skill for sieges. Hence a forty-foot wall was a real obstacle; even if they scaled it, they could not get their horses over. But they could force their beasts across most of the mountains in northern China, and the wall had to cross the ridges in order to be of real service. The streams were bothering interruptions, and the wall is bent about so as to avoid crossings so far as possible. It was never intended for a rampart across which armies should fight, but as a kind of masonry wire fence; and as such for fifteen or twenty centuries it protected the empire. The proof of its usefulness is that it was repeatedly repaired. It is now so much neglected that parts of it are forgotten; and an American, who is making a study of it, chanced upon a little stretch of two hundred miles which was not on the maps.

No other work of man compares with the Chinese wall for the human labor which it cost. It contains the mass of a hundred pyramids; its masonry would build a dozen Romes or fill six Panama Canals. The stretch of five or six miles across the plain to the

* Mr. Albert Bushnell Hart, Professor of History in Harvard University, published an excellent article recently in the Boston *Transcript* on his travels in China. What he has to say about the Great Wall, which he saw at its eastern terminus, is unhackneyed, and will interest the readers of the Bulletin. A part of Mr. Hart's description of his railroad journey from Peking to Hankow is also reproduced.

Dr. Geil's book "The Great Wall of China" is the most complete work on this remarkable structure, and is especially notable for the fine series of photographs showing many aspects of the Wall as he followed it throughout its extent.

mountains at Shan-hai-kwan is a majestic structure about fifty feet high, and from twenty to a hundred feet thick. In most places it has a stone foundation ten or twelve feet high, above which it is built of large brick about 15x10 inches, and 3¾ inches thick. Outside is a dry moat, apparently much later than the wall. In some places, especially in the crossings of streams, the inside is also a masonry face; but usually it is simply a slope of earth. The top, where preserved, is a paved road about twenty feet wide, with a parapet, in which are openings intended for swivel guns or cross bows. At intervals of a half mile or so are square towers which once had vaulted rooms for the guard. Outside the mountain section are remains of a much older and smaller wall. On the steep slope the wall rises inside by masonry steps about two feet high. Where the wall crosses streams there are remains of arched bridges now fallen in, but defended by unusually strong towers.

A walk along the top of the wall is delightful. On the outside to the north is a rolling country dominated by four enormous mud forts, some of which were built in 1895 to head off the Japanese. Inside lies the city of Shan-hai-kwan, surrounded by a wall five miles in circumference, over the entrance gates standing the lofty gatehouses, which are the pride of Chinese cities, and fitting into the great wall, which strikes out on the west to the mountains and commands a wide area of farms, villages, and countless graves, a brown and unpleasing landscape.

An extremely interesting rail journey is from Peking to Hankow. The weekly express train makes the whole distance of 800 miles in about thirty hours, but I preferred the slow train which lies up at night and takes the best part of three days. The accommodation was good. As the only first-class passenger, and for most of the distance the only foreigner on the train, I held the one first-class compartment, which was tolerably heated and lighted, and by special permission I was allowed to stay in the coupé over night instead of seeking the terrible Chinese inns. An outfit of provisions, supplemented by the excellent raised biscuit and fruit which can be bought at the stations, and the tea and coffee prepared by the boy in the den next the coupé made the journey comfortable enough. The row of second-class compartments was filled with well-to-do Chinese, one of them a Mongol nobleman and his family. His womankind wore elaborate silks, abounded in jewelry, had the imposing Mongol head dress, which is very like the Alsatian bow, walked on the Mongol clogs and were painted like Japanese dancing girls. Ap-

parently they had never been on a train before, for their lord pointed out a locomotive to them as a great curiosity.

This railway cuts a section through one of the most fertile parts of China, the enormous agricultural plain of the Hoang Ho basin, the home of perhaps a hundred million people. It is not unlike a journey from Buffalo to New Orleans, except that the population is in most places so dense as to make almost a continuous town. Right and left appear high walled cities, interspaced with smaller places. The villages are pitifully poor and foul, shut in by ruinous mud walls, and from the train hardly a building can be seen of any consequence. The villages and farmsteads are simply mud walls with flat roofs. The country is tilled like a garden, for in China the farm that supplies a family may not be more than an acre, on which several crops a year must be raised. The open country is punctuated with tumuli and tombs, with sometimes an absurd little temple; very rarely one sees a Christian church or mission refreshingly clean and neat. At the stations which are always placed outside the large towns, crowds of people assemble; here descends a demure "golden-lily-foot" with gorgeously painted face, her soberly clad mother protecting her; there comes aboard a bold huntsman in long black robe carrying a red banner and a gun over his shoulder, muzzle down, perhaps bearing some little hunting eagles on a perch like the old hawks. At every large station the platforms are crowded with passengers, with uniformed railway guards drawn up in a military line, with sellers of food and comforts for the journey, hot soup out of little hand kitchens, dainties that look like pieces of rope and old slippers, pieces of cotton cloth to wrap up one's belongings, and furs to keep the feet warm. It is a good-natured crowd, and just at present kindly disposed to the foreigner.

For hundreds of miles the railroad traverses this broad and fertile plain, with a fringe of forest behind and the interior mountains in the distance. Here as in most parts of China the eye is caught by the millions of graves. In most parts coffins are placed anywhere in the fields, sometimes left indefinitely on the ground, sometimes encased in brick, sometimes covered with earth. In many places a tenth of the available land is occupied with graves, frequently protected from Fengshuey by a crescent-shaped embankment.

About the midlle of the second day it approaches the banks of the Hoang Ho, which winds back and forth in a channel about half a mile wide and at this point navigable for junks. The bridge is a remarkable feat of engineering; it crosses a good mile of sandy

bottom before reaching the channel, and there have been times when the whole width was filled with a raging stream, which rose almost to the tracks. Since no rock bottom can be found, the bridge is supported by iron piers going down to supports, which rest simply on sand; and after every train passes the bridge must be inspected anew.

At the south end the line strikes the loess country, a region of hills two hundred or three hundred feet high, of stiff, fine material supposed to have been blown from the interior. It stands in fantastic cliffs and pinnacles, and is full of caves, many of which are occupied as dwellings by ladies in green and red trousers, who till the soil in the foreground or hobble about in their bound feet. This bit of loess is only a little corner of a deposit thousands of square miles in extent. Beyond, the country becomes rougher, mountains rise on both sides, and the railroad finally crosses a small range, which is the watershed between the Hoang and the Yangtse Rivers. From Peking to this point hardly a growing tree or a stone has been visible along the track. Now scanty patches of forest appear, and outcrops of rock. The hills are terraced for rice, and houses are seen with peaked roofs. The mountains look barren and worthless, although there are prosperous villages hidden among them. The Yangtse slope gets more rain, and the country looks prosperous.

This railway is a commercial success, and proves that new lines through populous regions will draw a large native passenger travel. The changes in transportation are perhaps the most profound influence at work to change China; more important even than education, for it makes possible a real national life. The Chinese are beginning to traverse their own country, to visit relations from whom they parted a century or two ago. Every mile of railroad is a new bond to hold China together.

THE ORGANIC SIDE OF GEOGRAPHY: ITS NATURE AND LIMITS*

BY

ALBERT PERRY BRIGHAM

At the outset the writer is disposed to adopt a sentiment expressed by H. R. Mill in his presidential address to the Geographers of the British Association,—"Discussion rather than acceptance is the best fate that can befall any attempt at stating scientific truth."

It is not proposed here to define geography. Attempts to form a complete and logical definition often result in mental confusion and unprofitable hair-splitting. The topic concedes an inorganic side of geography which is truly geographic. If relation between inorganic and organic is the only genuine geography, then physical geography, so-called, is all astronomy, geology, physics, meteorology and oceanography. But the physical and the organic are co-ordinate parts of geography and both distribution and relation belong to its concept, freely conceding that the highest synthesis of material and the chief goal of study lie in the field of relation of the earth to life and pre-eminently in the bond between man and his total environment.

The preliminary suggestion of the President of the Association, looking toward this conference, proposes "The organic, especially the human side, to discuss how far we ought to go in that direction, where useful limits may be set, also to indicate the kind of work on plants, animals and man that is truly geographic and not either botanic, zoölogic or historic."

If we should try to mark off strictly the boundaries between geography and these other sciences, I think we should find warrant in the above proposal, but I have some fear that we should not be able to see the woods for the trees. It is still left to us to find "how far we ought to go and where useful limits may be set." In his presidential address at our second annual meeting Professor Davis named three possible alternatives: (1) that the organic be left to the biological sciences and to history, (2) that the more manifest relation of organic forms be adopted into geography, (3) that we

* Read in opening a round table conference of the Association of American Geographers, Boston, Dec 31, 1909.

include all, even minute ontographic responses. He adopts this third alternative as essentially the position of Ratzel and Reclus, and cites as an example the overlapping of geography and philology in the field of names and terms used by man. Now, this seems to be for the geographer who is learned in philology or is willing to make a laborious journey into the philologist's field. Sound judgment and the measurement of one's powers are desirable, and I incline to the view that most of our work should follow the second alternative, dealing chiefly with unmistakable and commanding relations; in other words, setting "useful limits" in our traverse from the geographic toward the organic center. It will take a long time to delimit and systematize the material of geography and its full organization and definition will come gradually, if at all, as the outcome of many attempts in its several fields. Reclus has characterized the ethnologists as "squatters in the Far West of learning—they erect no structures which pretend to more than a provisional character." In the far future may come "stately edifices of marble." Notwithstanding the age and dignity of geography, some parts of our science are thus provisional, and we should move with deliberate steps. Meanwhile, there is enough ground for every ambitious geographer, ground which he alone is likely to explore.

The aims in this discussion are therefore practical rather than theoretical. We should aim at the best available conception of the earth and its life which is possible to the present generation. Such an attitude does not surrender fundamental problems as insoluble, but faces us most directly toward the broad and deep geographical philosophy which we desire for the future. And it must further be said that the rule of reserve and common sense does not bar out daring excursions for those who are able to make them, but we shall at the same time not lay ourselves open to the charge of making an indiscriminate raid into the fields of the organic sciences.

We will test our conceptions of what may be practicable geography in relation to several organic fields. Professor Clements in his Plant Physiology and Ecology gives the following as the factors of a habitat,—water, soluble salts, humidity, light, temperature, wind, soil, pressure, physiography, gravity, polarity and biotic factors. Geography unquestionably has to do with some of these factors, perhaps with all. But some, such as light, pressure, gravity and polarity, indeed all the factors in some of their special functions, must be left to the investigators in structural and physiological botany. The future, indeed, may develop generalizations which

shall take their place in Geography. Some principles are already available. The plant life of the globe offers a major geographical fact, as also many subordinate divisions of it, as related to land regions, water, climate. Here may also be classed such groups as hydrophytic, mesophytic and xerophytic societies, all depending on more or less abundant supplies of water. The supply of water is in turn dependent on meteorological and physiographic conditions, including the broad relations of continents, oceans, lakes, rivers and ground waters. Or, we may analyze, for example, the hydrophytes, and find free-swimming, pond and swamp societies, or follow the swamp groups and find reed swamps, swamp moors, sphagnum moors and swamp forests. This all sounds very geographic and studies of this sort are essential to even the broadest correct knowledge of the plant world, and thus become indispensable to our work in regional and economic Geography.

Next rises the question, who shall make such ecological study? Obviously, not the ethnographer or the meteorologist, but the botanist, and when the botanist does it he is working common ground, and it really makes little difference whether we call him a botanist, a geographer, a geographic botanist, a botanical geographer, or an ecologist. The essential is that the work is done and that its results are available to the biological specialist on the one hand and to the geographer on the other. The botanist may use the product as subsidiary to plant physiology and the geographer may find aid in understanding the distribution or industries of man, or as helping to form that great synthetic conception of the earth for which he is ever striving.

A similar inquiry relates to geo-zoölogy. Here arise abundant examples of geographic subjects. One of the chief of these is the distribution of animals. Shall the expert in this field be a zoölogist or a geographer? Perhaps he must be both. The answer to this query, in like manner, need not be considered as material. Insect and germ life in relation to public health offers another and specially important example, not only for tropical but for the temperate latitudes. Here the expert must be medical, and he must be trained in biological investigation. Must he be also a geographer? It would appear to be a gain if he is such, but if he is not, how much of his product belongs to geography? Must not the geographer, even though a layman to biological study, find some approach to this domain, and make use of its products? Certainly, the subject will become essential to general education, and geography seems to be

the only school subject which can give it a place. A third example is taken in animal life as related to agriculture and to food. Here is a recognized department of commercial geography, and geography should go farther than it now does in the recognition of importations and economic culture of animals, and in taking account of game protection and the control of disease.

On the other hand, vestigial organs in man, the origin and use of the glands of the stink bug and the evolution of the notochord are clearly subjects for zoölogists,—though even here a fundamental law may yet be made out, so general and so important as to demand a place in geography. If zoö-chemistry is nevertheless chemistry, zoö-geography may surely be considered as geography. It would certainly require a chemist to work in the one field and it does not seem that a zoölogist who is ignorant of geography could achieve in the other. The man who is more zoölogist and less geographer, and the man who is more geographer and less zoölogist would both be capable of certain work. The geographer in the organic field is certainly a geographer by virtue of the relation which he establishes between the physical and the organic.

There remains the still more important field of anthropo-geography. The range of human sciences and arts to which geography may claim a working relation is debatable. We begin at one end of the line where there is no question of right and proceed toward the fields which are more doubtful, or in which, at least, no safe lines have been drawn.

Haberlandt defines ethnography as descriptive ethnology. "It imitates the system pursued in the geography of plants and animals and keeps strictly to the divisions of the earth and their natural configuration, which correspond in the main with the fundamental divisions of the human races inhabiting them." This author makes three groups of factors in the development of man: external, internal and social. Of these the external factors at least cannot be other than geographical.

According to Reclus, we often compare ethnography and ethnology, but "if a distinction is to be made between them, an instinctive perception teaches us to speak of ethnographic facts and ethnologic theories, ethnology being related to ethnography as the wine is to the grape." These words were written many years ago, and would seem to emphasize the mere description and distributional phases more than is consistent with the ideals of the new geography. Must the geographer have nothing to do with the wine? In so far as

physical influence has shaped races, their bodies, homes, tools and customs, the geographer has at least some rights in the field. Perhaps the ethnologist will bear the brunt of the investigation, but his broader results are common property with the geographer and the geographer must supply the physical data which the ethnologist requires.

In approaching history it will promote clearness to observe at least three types of view as regards its relation to geography. To begin at one extreme, the present writer has elsewhere quoted such views as,—"man is what he eats," "character is a function of latitude," and, "history is nothing more than an echo of the operation of geographic laws." If these views were true, history would have to be classed as a mere province of geography, and, in theory at least, the expert geographer ought to be able to reconstruct history from the data at his command. Comment on a similar view is thus made by Reclus, and in so saying he draws a broad moral for over-ambitious geographers: "There is some truth in Buckle's statement that the history of the most civilized nations may be explained by the chemical constituents of their food, but until the action of aliments on bodily and intellectual organism is better known the discussion would be premature."

There is an opposite extreme. Professor G. L. Burr, in discussing a paper read by Miss Semple before the American Historical Association, argues that geography, while a factor, is only one factor. This, of course, all would concede. But he proceeds to urge that man is the more active factor, and that "we must not impute action or causation to things that are inert. This is a figure of speech which gives vigor to style but always involves fallacy." So far as we take this literally, we still must all agree. But possibly a fallacy lurks beneath the charge of fallacy. When the geographer finds a thing, or a group of things, in the field of land form, or in the realm of the atmosphere, or in the under earth, or in the heavens above, whose existence, or contact, or presence, have led to human action or movement of a given sort, is he estopped from saying that these things have *influenced* human life? This seems a sober and ordinary use of the mother tongue, and the geographer knows as well as anyone that a human volition stands between physical things and the current of man's action which we call history.

A more explicit expression of this extreme view is here cited from Mr. J. B. Bury in an essay on Darwin and Modern science:

"Environment and climatic influences must be called in to explain not only the differentiation of the great racial sections of humanity but also the varieties within these subspecies, and, it may be, the assimilation of distinct varieties. Ritter's anthropology has opened a useful line of research. But, on the other hand, it is urged that in explaining the course of history, these principles do not take us very far, and that it is chiefly for the primitive, prehistoric period that they can account for human development . . . . that physical environment has ceased to act mechanically, and in order to affect their activities, must affect their wills first, and that this psychical character of the causal relation substantially alters the problem . . . . Most thinkers agree now that the chief clews to the growth of civilization must be sought in the psychological sphere."

Our only comment on this view must be this,—if environment is so powerful to form races, why not to influence them in their maturer development? And by what right do we assume that psychological conditions and resulting actions are something apart from and above environment and in no way historically and genetically related to it?

A third and more reasonable view, which may be called intermediate, is formulated by the historian and statesman, James Bryce,—"Geography has to look upon man as being a natural growth who is conditioned in his development and progress by the forces which nature brings to bear upon him. He is in history the creature of his environment, not altogether its creature, but working out also those inner forces which he possesses as a rational and moral being, but on one side, at all events, he is largely determined and influenced by the environment of nature . . . . man in his early stages is at the mercy of nature. In process of time he learns to raise himself above her. It is true he does so by humoring her, so to speak, by submitting to her forces. *Natura non nisi parendo vincitur.*"

This statement appears to do justice to all the elements concerned, whether looking at nature or man, at primitive or advanced culture. We need not ascribe anything like volitional initiative in order to credit environment with a strong force in shaping the current of human life. If the substance is there, the fallacy lies in trying to dodge it. If a great body of essential truth is found in a common field, it is a waste of time for the geographer and the historian to wrangle for the possession of it or for some particular

designation of it. It is better to cultivate the ground and reap the mutual benefits of it, a history made concrete and rational and a geography enriched by themes of the highest interest.

Granted that there is a generous overlap of the two subjects, what, precisely, is the geographer's function in the case? If he enters the field of history at all, even on what he thinks is a geographic errand, ought he to turn back, on the more or less current supposition that "a man cannot know anything about a subject unless he knows nothing about any other"? This in no degree represents the general attitude of historians. Indeed, Ripley characterizes Freeman and Bryce as "apostles" of the new emphasis on environment and cites Winsor's Mississippi Valley as another great example. I see no reason why we should not accept for history the principle which Ratzel lays down for ethnographical study, that "the geographical conception of their surroundings and the historical consideration of their development will thus go hand in hand."

As to the actual division of labor, no line can be drawn. From either side it is possible to wander across the boundary, according to the bent of the individual worker. It will fall to the geographer to put in order the physical data, and to the historian will surely remain, as ever, the growth of law, constitutions and political systems and the development of states with their corporate life. But there is another group of themes, as, for example: our progressive knowledge of the globe and its historic availability to man; the relations of major regions to each other and to embracing seas; races or nations in reference to the homes that have molded them; the chain of influence that extends from resources to occupations and from occupations to character; all military operations; the position and influence of lines of migration and transportation; the distribution of population; the fixing and unfolding of centers of industry. Here is a continental opportunity for the geographer and the historian, each to show due reserve, each to enrich the labors of the other, and each able at any moment to retire into fields of research where the other would not think of following him. If geography is ever to push farther into the psychical-historical realm, it will then have demonstrated its right to be there, but this is a problem for the future.

An examination of some standard texts of economics for their scope and content will not be without profit. According to Hadley, economics deals with a nation's commerce and finance. This looks as if commerce belonged to economics and not to geography, but a

further look shows that capital, money, credit, profits, wages, labor and revenue are the typical themes of the economist. Walker's main divisions are: production, exchange, distribution, consumption. These sound geographic, but on examination we find labor, capital, etc., but nothing approaching the geographic conception of production and products. So exchange has to do with money, and distribution with rents, interest, profits and wages. Ely refers to chemistry, psychology, mathematics and the social sciences as related branches of knowledge, and he has a paragraph on "our environment" which closes by turning over the "economic significance of our physical environment" to the economic geographer. He also gives a short chapter on the economic development of the United States, with brief passages on natural resources, agriculture, manufactures and transportation.

Bullock sketches our economic history before taking up economic theory and in so doing touches such geographic themes as the fur trade, cattle raising, agriculture, fisheries and mining, which he calls foundational industries. He has also a chapter on manufactures, transportation, ship building, textiles, iron and steel.

On the whole, while some, perhaps all, of the economists appreciate the value of basal geographic studies, they would seem to leave the whole field open to the geographer, a field unlimited and largely untested in its educational and practical value and possibilities. No geographer need sigh for doubtful excursions into remote territory, while this field, so close to the earth, so close to man and so full of environmental relations, is at his door and is, in effect, all his own.

If geography is basal to economics and is part of the very structure of history, it cannot escape a relation to sociology, a relation so deep and pervading that it cannot be overlooked. I quote a single illustration, drawn from Ripley in his discussion of the racial geography of Europe. He meets the argument that certain social phenomena, as divorce and suicide, seen in France, are racial. "Our theory, then, is this, that most of the social phenomena we have noted as peculiar to the areas occupied by the Alpine type are the necessary outcome, not of racial proclivities, but rather of the geographical and social isolation characteristic of the habitat of this race. The ethnic type is still pure for the same reason that social phenomena are primitive. Wooden ploughs pointed with stone, blood revenge, an undiminished birth rate and relative purity of physical type are all alike derivatives from a common cause, directly physical and coincidently social. We discover primarily an influence of environ-

ment where others perceive phenomena of ethnic inheritance." By a similar argument he urges that divorce and suicide, which are uncommon in the Alpine regions and are common in the densely populated region of commingled races of which Paris is the center, are not matters of race, but follow ultimately upon conditions of environment. Such views, if true, or if partially true, offer a field for geographic investigation. If tilled by a sociologist, he must go back of statistics and economic conditions and know the physical environment in relation to society,—he must become in fact a geographer.

By technology we mean the methods and instruments of the useful arts. How far can we study them as a part of geography? They certainly belong largely to physics and chemistry. Let us take for example the technology of iron.

Iron relates itself to economic geology, in the mode of occurrence, origin and amount of ores, their composition and qualities. Already we have invaded the province of chemistry. Economic geography takes heed of another group of facts, the distribution, national or worldwide; of transportation routes, manufacturing centers and markets. Roughly, there stands between these two groups a variety of technological processes, of mining and handling, of smelting, steel making, steel working, all depending ultimately on mechanics and chemistry, but distinctly human in their relationship. How far are they geographical? Take the basic process. Is an account of it *per se* geographical? No. But a general knowledge and reference are geographical if its adoption should make a great country, as Canada, a foremost producer, when it was not before. We observe also the migration and expansion of the iron industry by the passing of charcoal and the adoption of coal. Likewise the use of charcoal in Sweden is a geographic fact pointing to paucity of coal and to the yet abundant forests of that country. Geography, therefore, especially geographic education, is bound to step broadly across the field of geology and technology in order to reach with sure bearings its own proper territory. And when it has arrived at its own goal, it will find itself close to economic and sociological considerations which can never be far away from so vast and highly organized and highly capitalized an industry as iron represents today. We take another example, wheat. Such considerations as latitude range, climatic and soil conditions, transportation, primary and ulimate markets, are distinctly geographical aspects. But there is a technology of wheat involving the steam plow, the harvester-

thresher, elevator construction and operation, modern machinery and methods of milling. These appliances and processes are mechanical, not geographical, but they and they alone have rendered possible the vast expansion of wheat and made it the bread of nations. Hence these processes have a geographic relation. The geographer will not investigate the processes to minute detail, nor become an inventor of technical methods, but he cannot omit them from his circle.

Wheat, like iron, illustrates the manifold intersection of all circles of knowledge and activity; for further, it has a history, which belongs both to botany and to general history. It is the subject of refined experiments in breeding, in which it is, indeed, botanical, but is also geographical, as when a wheat from an altitude of 11,000 feet in northern India, and a wheat from a high latitude in Russia are brought to Ottawa and crossfertilized, to make an early ripening wheat that will extend wheat culture into the basin of the Mackenzie River.

The qualities of wheat carry us into the domain of nutrition and physiology, but may involve a geographical relation, as when a macaroni wheat is imported from Russia, grown on our Great Plains, and returned by millions of bushels to make the bread pastes of France and Italy. And we need but mention the wheat pit, the railroad and the farm mortgage, or see a Winnipeg bank sending out its daily bundles of currency to move the crop of the Canadian Northwest, to find the relation of wheat to economics, and to see it as the engine of civilization and the opening wedge of history over half a continent.

Cotton and many other products would show the same relation of geography to technology and a similar complex of ties binding it to manifold fields of knowledge and research. But we may challenge any or all of these related themes to take up and co-ordinate all the parts of the great whole as geography is privileged to do.

Such examples, I grant, seem to bear out the view of Mill that geography is "to co-ordinate and correlate all the special facts concerned so that they may throw light on the plan and the processes of the earth and its inhabitants," and is not concerned with the processes of the special sciences. Does this destroy the idea of original research in organic geography and make it a sort of secondary science? I do not think this a fair inference. We might as well charge philosophy with being superficial because it aspires to unify and rationalize all knowledge. Rather adopt the view of Ripley

that geography has made good its claims, "until to-day geography stands ready to serve as an introduction as well as a corrective to the scientific study of human society." What now if the deep researches in the atmosphere are made by the meteorologist and he prefers to be called a meteologist? And suppose the human relations and principles are developed chiefly by the ethnologist, the historian and the sociologist, they using the materials made ready by the physiographers, meteorologists and by their fellow humanists. Does it turn out that geography itself offers no field of research, but may only use second-hand the treasures of more fortunate investigators? Are we thus left without a science? Let us see.

Most of the members of this association are well centered, in biological science, in meteorological science, in geomorphology, in ethnology. I think we are not favored by the membership of anyone who counts himself a historian. And suppose these men are willing to be counted also as geographers, and hold out their hands toward a great common ideal, that unifying grasp of the whole globe and its life which is more than any one science. Is not this enough? Every man has his special field of detailed research. And every man tests and broadens his knowledge by coördinating it with related truth.

And who can doubt that on such foundations, the master mind or minds will arise to construct a more lofty conception of the machinery and life of the globe? This would be the higher justification and apotheosis of the science of geography.

A NIGHT AMONG WILD ANIMALS*

"As game was plentiful at Serah, and there was only one waterhole for the animals to drink from, I thought to myself that this would be an excellent place to make observations by night. I therefore had a boma [inclosure] made close by the spring so that I might sit and watch the various beasts in the brilliant moonshine as they came to quench their thirst. I had the camp purposely

* The BULLETIN referred, in its review of Lieut.-Col. Patterson's book "In the Grip of the Nyika," to the night that he spent in hiding at a solitary waterhole where many species of animals came to drink. Through the courtesy of the Macmillan Company, publishers of that work, the BULLETIN is permitted to print here the author's brief and graphic description of what he saw while lone with the wild life of tropical East Africa.

pitched over half a mile away, in order that the animals should not be kept from the water or be disturbed during the night.

"After dinner I took up my position in the boma, in which I had had many loopholes made, not for the purpose of shooting from, but to serve as peepholes, so that I might be able to see in all directions; and I was well rewarded for the trouble I had taken.

"I had not been in my stockade for more than an hour, when in the distance I heard pad, pad, pad, pad, and a few seconds afterwards up stalked a very tall giraffe, followed by twelve others, their heads being apparently on a level with the tops of the palms. It was the wierdest thing imaginable to watch these huge ungainly creatures stride past within twenty yards, all the time twisting their heads from side to side, keenly on the lookout, and yet totally unconscious of my presence. When they had had their drink at the waterhole, they stalked off again, and later on were succeeded by others at various times throughout the night. None of them went down to the water direct, but circled round it first to see if there were an enemy, in the shape of a lion or other rapacious beast, in sight. One elephant came and had a long drink and a bath, and then leisurely went his way down the bed of the river.

"It was a perfectly still night, without a breath of air blowing, which probably accounts for the fact that the animals did not wind my boma.

"Soon after the first troop of giraffes had gone, a band of about twenty oryx came to within thirty yards or so of the water, and there halted and stood gazing at it. Then, evidently at the command of a leader, all rushed impetuously down into the river bed, drank greedily, and galloped back to their former position. After a pause there, they again charged down together, drank their fill and galloped off into the night, this time returning no more. Undoubtedly, they adopted these tactics owing to their fear of lions lurking in ambush about the waterhole. It is probable that no beast of prey would attack a herd of this size if they meant to stand by one another, as the oryx, with its long, sharp, and strong horns, set on a powerful head, is by no means to be despised as an antagonist, even by a lion. It would be very interesting to know if they would have made common cause against one had he appeared.

"An hour or so after this, scores of zebra came to drink, and then, to add to the interest, a lion at last arrived on the scene, and began to prowl stealthily round. I thought he was coming straight up to my boma, so much so that I reached out for my rifle and went

to the loophole which he seemed to be approaching. I watched carefully for him, but for some reason he must have doubled back and crouched under a clump of bushes which grew on the bank by the water. I did not actually see him go into these bushes, but felt pretty sure that he had hidden himself there. He gave absolutely no sign of his presence, however, and I began to think that he must have gone away along some fold in the ground where I could not see him. I soon found that this was not so, for just then some zebras came along, and as they passed close by, the lion made a mighty spring out of the bushes, pounced on one, dashed it to the earth, and apparently instantly killed it, as it hardly moved again. He lost no time in dragging it to the bank on the other side of the river-bed and over some rocks out of my sight. Here he was joined by several other lions, and the noise they made over their feast was appalling. They all disappeared before daylight, and there was very little left of the zebra when I went out to investigate.

"As the night wore on, rhino after rhino came walking towards the water with the gravest unconcern, every species in the neighbourhood making way for him except his own kind. Finally, towards dawn, the whole place abounded with hyenas. I counted eight all present at one time, and one of these, more inquisitive than the rest, came sniffing round my boma to see what was there, and so paid for his curiosity with his life. He proved to be of a rather rare kind, the striped hyena.

"A night such as this spent among the animals in the wilds, watching their habits and methods both of aggression and self-defence, compensates the lover of wild life for the trials and hardships endured on many a toilsome march in this hot and thirsty land."

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

MEETINGS OF THE SOCIETY. A regular meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday Evening, March 15, 1910.

Vice President Greenough in the chair.

The following persons, recommended by the Council, were elected to Fellowship:

Emilie Andrews Deen,	Samuel Sloan,
Newell Martin,	William S. Sloan,
Bradley Martin, Jr.,	Pierre J. Smith,
Benson B. Sloan,	Theodore N. Vail.

Vice-President Greenough then introduced the speaker of the evening, Professor A. V. Williams Jackson, of Columbia University, who addressed the Society on "Persia: The Land of the Lion and the Sun." His discourse was illustrated by stereopticon views. The Society then adjourned.

Another regular meeting was held at the Engineering Societies' Building on Tuesday evening, April 26, Vice-President Raven in the chair. The following persons, recommended by the Council, were elected to Fellowship:

J. Coleman Drayton,	Barend van Gerbig,
T. P. Gilfedder,	Thomas M. Osborne,

John B. Stetson, Jr.

Vice-President Raven then introduced Mr. Henry G. Bryant, President of the Geographical Society of Philadelphia, who addressed the Society on "Java: The Gem of the Orient." Many lantern views were shown. The Society then adjourned.

NORTH AMERICA

SURFACE WATERS IN THE NORTHWEST. A report on the flow of rivers of the Northwest that empty into the Pacific Ocean has just been published by the U. S. Geological Survey as Water-Supply Paper 252. These streams are in Washington, Oregon, Idaho, and northwestern Montana.

The report gives records of flow at 127 gaging stations on 83 rivers and creeks; also records of the stage of water on four lakes. The streams range from small creeks to large rivers, including the Columbia. These streams drain areas of widely different character, as may be seen by comparing the barren desert of central Oregon with the heavily forested slopes of the Cascade and Coast ranges, where the annual rainfall in some places exceeds 100 inches.

In the region considered in this report the U. S. Reclamation Service has seven projects under construction, covering an irrigable area of 776,000 acres, and has eight projects under consideration. Private capital is developing at least twelve projects under the authority of the Carey act, the largest, the Twin Falls project, covering an area of nearly 500,000 acres. About 1,500,000 acres are under irrigation in the Northwest and this area will be more than doubled when the projects

now under way are completed. The water power available in this region is very great. The streams draining into the north Pacific Ocean will furnish at low water over 12 million horsepower—one-third of the total for the United States.

SURVEYS IN ALASKA THIS YEAR. The United States Geological Survey has placed twelve parties in the Alaskan field this year. As in previous years, the work will consist of explorations, reconnaissance and detailed surveys, study of the geology and mineral resources, and, in the placer districts, stream gaging. J. W. Bagley, assisted by C. E. Giffin, is continuing the detailed topographic survey of the Eagle River district begun last year. It is proposed to complete the survey of the gold-bearing belt which lies between Juneau and Berners Bay.

A systematic investigation of the Alaska coal fields was begun in 1902. Reconnaissance surveys have now been carried over nearly all the coal-bearing areas that are of immediate economic importance and detailed investigations of some of these areas are now in progress. The detailed survey of the Matanuska field will be undertaken this season. The survey will be made under the direction of G. C. Martin, assisted by F. J. Katz and Theodore Chapin.

The most extensive survey will embrace a region between the Gulkana (a westerly tributary of the Copper) and the upper Susitna. Placer gold has been found in commercial quantities on Valdez Creek and has been reported to occur on other streams in this field. Except for the work of the prospector this region is practically unknown. The plan for this season contemplates a topographic and geologic reconnaissance map of the area lying between the Valdez-Fairbanks trail and the upper Susitna, including the southern slope of the Alaska Range. F. H. Moffit, assisted by B. L. Johnson, will undertake the geologic work in this district. This party will also make a supplementary study of the Chistochina placer district, which has not been examined by any member of the Geological Survey since 1902. D. C. Witherspoon, assisted by C. E. Griffin, will carry on the topographic work.

The water resources available for placer mining in the Yukon-Tanana region will be further determined by C. E. Ellsworth and G. L. Parker, who began work in the Fairbanks district in April and later extended it into the Circle district. Practically the entire Yukon-Tanana area has been mapped, except a belt lying south of the river and west of the Delta. A reconnaissance survey of this belt, which contains some extensive lignite deposits as well as gold placers, will be made by J. W. Bagley, topographer, and S. R. Capps, geologist. The party will land near the mouth of Nenana River about the end of June and go southward to the base of the Alaska Range, there beginning a survey which is to be extended eastward to the Delta, covering the Nenana coal field and the Bonnifield placer district.

The reports from the Innoko placer district are so encouraging that it is now proposed to make a geologic and topographic reconnaissance survey of the more important part of it, including the northern part of the Haiditarod basin. This work will be done by A. G. Maddren, geologist, and C. G. Anderson, topographer.

In Northern Alaska last season, an exploratory survey was extended westward from the lower Yukon to Seward Peninsula. This year it is proposed to carry a similar survey northward from the bend of the Koyukuk to the Kobuk and thence southwestward to Candle, in Seward Peninsula. This expedition will not have time to gather much detailed information, yet it is expected to procure

sufficient data for a general geologic and topographic map which will be of value to the prospector.

Alfred H. Brooks will continue the supervision of Alaskan surveys and investigations. He will be employed in office duties in Washington until about the end of July and will then start for Alaska, where he will join the Martin party in the Matanuska coal field. Later he will visit the Knopf party in the Juneau district and will then go to Fairbanks and finally, in the fall, to Nome.

During the year C. W. Wright will complete the report on the copper deposits of the Kasaan Peninsula and Hetta Inlet regions, U. S. Grant and D. F. Higgins will complete the report on the geology and mineral resources of the eastern part of Kenai Peninsula, and L. M. Prindle will be engaged in preparing a detailed report on the Fairbanks gold district.

THE YAKUTAT BAY REGION, ALASKA. R. S. Tarr's report on the Physiography and Glacial Geology of the Yakutat Bay region, Alaska (Professional Paper 64, U. S. Geological Survey, 1909, 1-144), is based upon two summers' work in a region made classical by the reconnaissance studies of Russell and Gilbert. Additional interest in this area has resulted from the recent great oscillations of many of the ice tongues in the region. The work upon which this report is based was financed by the United States Geological Survey, the first summer aided by a grant from the American Geographical Society. The first of these results were described in the BULLETIN (Vol. 38, 1906, pp. 99-101 and 145-167).

THE SWITZERLAND SOCIETY. A society of this name has been organized in New York whose purpose is "to create and encourage the desire to visit Switzerland and to do everything possible to facilitate the achievement of such object by every member of the society." The society is open to all interested in Switzerland without fee beyond the registration charge of ten cents and 25 cents for subscription to Current Topics, the official organ which is published monthly. H. M. Somner is President and W. Widmer, Secretary, the latter's address being P. O. box 266, Madison Square Branch, New York. We have received from the Society a number of handsomely illustrated brochures on various parts of Switzerland.

SOUTH AMERICA

THE ALTITUDE OF MOUNT HUASCARÁN. The following letter has been received from Mrs. Fanny Bullock Workman giving more particulars of the triangulation work last year, at her expense, of the summits of Mt. Huascarán in Peru (*Bull.* Vol. 42, No. 1, p. 55, 1910). Her investigation was suggested by the statement of Miss Annie S. Peck, who ascended one of the peaks of Huascarán in 1908, to the effect that this Peruvian mountain is higher than Aconcagua, to which Schrader, the latest investigator, had assigned a height of 22,812 feet. Mrs. Workman says:

"Believing Aconcagua to be the highest Andean peak, I decided to have a careful detailed triangulation made of the two summits of Mt. Huascarán. Through the assistance of Messrs. Fr. Schrader and Henri Vallot, acting for the Société Générale d'Études et de Travaux topographiques of Paris, an expedition was sent to Peru for me under the direction of M. de Larminat to effect this purpose.

"Assisted by the Peruvian Government and favorable weather, M. de Larminat

and his assistants were able to carry out this work successfully between August and November, 1909.

"A base 1,600 meters (5,248 feet) long was measured in the Rio Santa valley in the Black Cordillera at an altitude of 3,800 meters (12,464 feet). This base was measured by means of a 50 meter (164 feet) tape of Invar metal. From two stations, one at either end of this base, and from two others, the positions and altitudes of which were determined by trigonometrical measurements from them, that is, from four stations in all, the positions and relative altitudes of the two summits of Huascarán were fixed by azimuthal and zenithal angles taken by theodolite.

"In order to ascertain the true height of these stations above average sea-level, a progressive leveling was conducted from the highest station, called the Garganta Signal, down along the mule-path leading from Yungay by way of Quillo to the sea at the port of Casma.

"The Garganta Signal is higher than the col where the path between Yungay and Casma reaches its highest point. The difference in height between these two was ascertained by triangulation from the Garganta Signal to be 159 meters (521.5 feet). From the col down to sea-level at the port of Casma the leveling was performed by means of the tacheometer. The altitude of the Garganta Signal being thus established, it was an easy matter to fix the altitude of the other three stations, from which the triangulation of the summits was made.

"From two of these stations, from which it was visible, the altitude of the church tower at Yungay was also established at 2,568 meters (8,432 feet).

"The average sea-level was determined by four double observations of two water-marks made at intervals of six hours ten minutes between each. The agreement of these was satisfactory, owing to the small amplitude of the tide at Casma, and also to the fortunate circumstance that the observations were made at time of neap tide.

"The results of these measurements show the height of the north peak of Huascarán to be 6,650 meters, 21,812 feet, and the height of the south peak 6,763 meters, 22,182 feet. FANNY BULLOCK WORKMAN.

"BISKRA, Feb. 18, 1910."

THE FORESTS OF BAHIA, BRAZIL. The depletion of the timber resources of the densely populated states of the northern hemisphere has stimulated a rapidly growing interest in the timber resources of South America. Brazil has been of chief interest in this connection by reason of the large number of navigable streams that drain her forest lands and the nearness of many of her forests to the sea. An examination of the forests of Bahia has recently been made by the American Consul at Bahia with interesting results (Daily Consular and Trade Report, No. 3685, Jan. 14, 1910). The state is wonderfully rich in rare timbers such as rosewood, mahogany and cedar. It is found that between the 13th and 19th parallels of south latitude, and the Atlantic Ocean, there are 12,000,000 acres of choice timber lands which will yield a total of 120,000,000,000 board feet of cabinet woods, the percentages of the different woods, named after their American equivalents or near-equivalents being as follows: Rosewood, 1%; jacaranda cabiuna, 5%; mahogany, 10%; oak, 15%; hickory, 20%; birch, maple, elm, ash, etc., 40%; and Spanish cedar, 9%. The zone of woods has a coast line of 300 miles, along which are numerous ports. Not less than nineteen rivers,

navigable for scores of miles, traverse the region in an easterly direction, an important feature as much of the timber may be driven down the rivers to the sea. A large part of the timber districts is owned by the Government and can be operated only by Government concession. In spite of these favorable conditions, there is, as yet, but little lumber production and some lumber is actually imported from this country. Ordinary lumber costs from 9 to 10 cents per board foot in Bahia.

ISAIAH BOWMAN.

ASIA

PROFESSOR JACKSON'S LECTURE ON PERSIA. In Prof. A. V. Williams Jackson's lecture before the Society, on March 15, on "Persia: the Land of the Lion and the Sun," he said that it is now also the country of the new constitution and the youthful Shah. Herodotus tells us that the Persians were the readiest of all nations to adopt foreign customs and foreign ideas. There was, perhaps, something significant in these words, and in adopting new customs Persia may have lessons to teach in the future as she taught them in the past.

The great table land of Iran covers an area nearly one-fifth as large as that of the United States. Mountains guard its every approach. A portion of the vast plateau is well-watered, but there are no rivers in Persia worthy of the name. Irrigation is widely practiced, and some of the districts of Persia are the most fertile in the world. Railroads are yet to be introduced, as Persia can at present claim only half a dozen miles of track. With transportation facilities the country is capable of great development.

It is most instructive to journey, as the writer has done, past Lake Urumiah in northwestern Persia westward and southward to the historic sites and monuments of Persia's greatest glory in the time of Cyrus and Darius; to visit the homes of the greatest Persian poets at Shiraz on the way towards the Persian Gulf; to cross northward through the central desert to Yezd, the chief headquarters of the few remaining Zoroastrians in Persia; thence to visit the capital, Teheran, and the neighboring Rei, with its ancient ruins; to follow the track of Alexander the Great through northern Iran, visiting the holy city of Meshed; and to cross over the mountain barriers into Russian Turkistan.

MR. BRYANT IN JAVA. In the lecture of Mr. Henry G. Bryant before the Society, April 26, on Java, he described his recent journey along the east coast and through the interior of the island. He was impressed with the distinctly paternal character of the Dutch colonial administration and said it had been the policy of the government, till recently, to discourage foreign travel in the Dutch East Indies. The most prominent features of his lecture were his descriptions of the people in various parts of the island, of his visit to the central volcanic region where he ascended to the crater of the active Bromo volcano, of his excursion to the heart of old Java, where the natives have been least affected by foreign influences and of the famous and colossal ruins, the monuments of the early civilization of the island. The lantern views that illustrated his interesting discourse were especially effective.

EUROPE

THE SERVIAN GEOGRAPHICAL SOCIETY. Our Society has been officially informed of the organization of the "Société Serbe de géographie" at Belgrade. The pur-

pose is to promote geographical science in the largest sense; that is to say, it will include the allied sciences of geology, climatology, phytogeography, ethnography and historical geography, as relates to the Balkan Peninsula, and, especially, Servia. The meetings of the Society will be devoted not only to the purely scientific aspects of the study but also to its popularization. Beginning in January next, the Society will issue a quarterly publication. The President of the Board of Direction is Professor Jovan Cvijic, who occupies the chair of Geography in the Royal University of Servia and is well known for his contributions to the knowledge of Karst phenomena in the Balkan Peninsula.

POLAR

Mr. Stefánsson's Notes from the Arctic. Mr. Stefánsson, in a letter to the *Bulletin* dated "Near Cape Bathurst, Canada, Aug. 26, 1909," says:

"On the night of Jan. 1 a terrible S. W. storm took the ice from the beach at Flaxman Island and by morning it was out of sight. There was nothing but open sea to the Northwest, North and West.

"During the whaling season at Cape Smythe, about May 20, two whaling umiaks belonging to Mr. C. DeW. Brower (the Cape Smythe Whaling & Trading Co.) were carried off with the ice in one of the severe North-Easters. The boats contained 12 or 14 Eskimos and one white man, Mr. J. Hadley. They were beyond sight of land all but the last two days of five weeks and got ashore at Cape Lisburne about 230 miles S. W. of Cape Smythe. They had been without food two days and had thrown away about $5,000 worth of whalebone and whaling gear. They secured no seal or walrus, but two polar bears. When lost they had with them a ration intended for two weeks. None of the men was the worse for the experience. I give this as throwing some light on the movement of the ice.

"Capt. C. Th. Pedersen, of the trading and whaling schooner *Challenge* of Unalaska, told me that near the Jones Islands in August this year he passed a large floe, about a half mile square, which was in parts level, partly covered with rounded hills of ice, and had near one corner a rounded hillock higher than the 'crow's-nest' of his vessel—which, he estimates, is 60 feet above the water. Capt. Stephen Cottle of the steam whaler *Karluk* says he has frequently seen pressure ridges as high as his yards—60 to 75 feet. Both these gentlemen I consider reliable. The 'crow's-nest' is, of course, a good vantage point from which to get the approximate height of objects almost or exactly on a level with the observer's eye. This matter of the height of the ice in the American Arctic Sea is interesting in comparison with the observations of Nansen and others, who place the maximum pressure ridges north of the old world at 35 to 40 feet.

"There are in print, in more places than one, statements to the effect that boulders are rare on the coast west of Flaxman Island, Alaska. Paddling or tracking an umiak along this coast has given one ample opportunity to know that, excepting in river deltas proper, there is not a five-mile stretch without boulders between the location of the mythical "Gwyder Bay" of the maps, just east of the Colville, to Herschel Island, unless it be indeed the first five miles west of Herschel, where I did not follow the shore. There are boulders at Cape Simpson and at various points between that cape and the Colville. Natives say there are boulders here and there inland from Point Barrow. These boulders range in

size from a man's head to the dimensions of a large wagon load of hay, and are of varied structure. I have never seen a stone larger than a hen's egg actually imbedded in the ice, but gravel is common though usually in the form of a mass of frozen earth of a gravelly nature; just as other masses of earth in the ice are sand, still others river silt, peat, etc. Boulders seem especially frequent along the higher cutbanks—leading one to suppose that they are about equally distributed along the various parts of the shoreline. True, there are stretches of a mile or two here and there without a stone of noticeable size; some of these stretches include cutbanks, and even ice-bearing cutbanks.

PHYSICAL GEOGRAPHY

GLACIAL LAKE OJIBWAY. The glacial lakes marginal to the retreating continental ice sheet in the basin of the present Great Lakes have long been described and known. Of those north of the Hudson Bay divide Glacial Lake Agassiz was long ago mapped and discussed by Upham. It has remained for Coleman to give a name to the marginal glacial lake between the Height of Land and Hudson Bay in the region north of the Great Lakes (Lake Ojibway: Last of the Great Glacial Lakes. By A. P. Coleman. Eighteenth *Annual Report* of the Bureau of Mines of Ontario, Vol. XVIII, Part 1, 1909, pp. 284-293). Glacial Lake Ojibway is thought to have covered approximately 33,000 square miles at the maximum stage and to have been not more than 500 feet deep. Its existence is proved by the association of lake-bottom deposits, such as clay and other fine materials, with favorable topographic conditions, namely a northward-retreating ice sheet which would pond back waters against the divide of the Height of Land. Several probable outlets are discussed, the latest being in Quebec east of the Ontario boundary some 300 miles northwest of Montreal. The lake bottom clays are thought to be all freshwater formations and marine deposits are not known to extend more than 450 feet above James Bay. The later relationships of Lake Ojibway are uncertain.

The probable area of this glacial lake, which has been little studied as yet, is shown by a sketch map. Much needs to be done to determine its relations to glacial Lake Agassiz on the west, to the water bodies on the north and to clear up other important questions. LAWRENCE MARTIN.

TERRESTRIAL MAGNETISM. In the Annual *Report* for 1909 of Dr. L. A. Bauer, Director of the Department of Terrestrial Magnetism of the Carnegie Institution (Year Book No. 8, pp. 194-202, plates 12, 13, 14), he notes the completion of the *Carnegie,* the vessel designed for the special needs of a magnetic survey of the oceans, and says that excellent progress was made by all the field parties. Magnetic work was carried on in British North America, Central America, West Indies, Colombia, Ecuador, British, Dutch, and French Guiana, Africa, Persia, Turkey, Asia Minor, southern Asiatic Russia and China. All operations were conducted in regions not easily traversed and in general where very few, if any, magnetic data had been obtained previously. Special expeditions had consequently to be organized and detailed reports given show that they terminated successfully in each case. Besides magnetic data, other information of a geographic nature was obtained. In the office at Washington, the reduction of the observations kept pace with the field-work. However, owing largely to the construction of the *Carnegie* and of her instrumental equipment, it was not possible

to complete the report of the *Galilee* work in the Pacific Ocean (1905-08), but good progress was made, and the results will soon be ready for publication. The report gives a synopsis of the work done during the year.

PERSONAL

Sir Clements Markham has resigned the presidency of the Hakluyt Society. His services as Secretary and President have extended over 50 years. His successor as President is Mr. Alfred Gray, well known by his edition of Pyrard de Laval and Counsel to the Chairman of Committees of the House of Lords.

A geographical Society was organized in the German seaport of Rostock on Nov. 16, with a large membership. Dr. W. Ule, professor of geography at the University in that city, was elected President.

Mr. A. J. Herbertson, reader in geography at Oxford University, has been appointed to a professorship of geography.

Dr. Karl Uhlig, of Berlin, has been called to the chair of geography at Tübingen, to succeed Professor K. Sapper.

Dr. Alfred Grund, of the University of Berlin, has been made professor of geography in the German University of Prague.

The Royal Geographical Society has awarded a special gold medal to Commander Peary for his journey to the North Pole and for such scientific observations as his opportunities permitted; and a silver replica to Captain Bartlett for attaining 88° N. Lat.

Mr. Emmanuel de Margerie, the well-known French geographer and geologist, has been elected President of the Paris Geographical Society for 1910.

At the close of a lecture by Dr. Sven Hedin in Rome, on Jan. 30, the King of Italy gave to him the large gold medal that had been conferred upon him by the Italian Geographical Society.

Dr. R. DeC. Ward has been promoted to a chair of climatology at Harvard University.

Mr. Clarence C. Stewart, who had charge last year of the Carnegie Institution magnetic expedition to James Bay, has been assigned to magnetic work in South American countries, especially in Peru, Brazil and Bolivia.

Prof. R. E. Dodge has a valuable paper in the May number of the *Journal of Geography* on "Geography in the Rural Schools" from the forthcoming volume on "The Teaching of School Geography" of which Prof. Dodge and Miss Clara B. Kirchway are the authors.

Colgate University has conferred the degree of Doctor of Science upon Dr. J. M. Clarke, State Geologist and Director of the N. Y. State Museum.

The Italian Geographical Society has made Sir Harry Johnston a Corresponding member and given its gold medal to the Prince of Monaco.

Dr. A. Stein, the Asian explorer, has been elected an honorary member of the Scottish Geographical Society.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Ferdinand v. Richthofens Vorlesungen und Allgemeine Siedlungs-und Verkehrsgeographie. Bearbeitet und herausgegeben von Dr. Otto Schlüter. pp. 16 and 352, Sketch-maps and Illustrations. D. Reimer. Berlin, 1908. M. 10.

These lectures have been edited by Dr. Schlüter as an historic document, from the year 1891, and not as a contribution to the modern science of geography. They were published as an illustration of Richthofen's method of geographic thought and doctrine. This purpose is made distinct in the preface and disarms criticism that would otherwise be inevitable. But the purpose is one that shows more respect to the master than to geography. To students of earth-lore who were not so fortunate as to have the great student of China as teacher this is not wholly satisfactory. Thirty-five pages of race-classification, for instance, on the basis of straight or curly hair was original with Friedrich Müller in 1873. Here they are of little interest. The mass of readers will recognize that the volume is a memorial one and not for them. Geography is presented as a vast mass of interesting facts about the earth and its inhabitants. That Richthofen cared more for completeness than connection is the strongest impression the book makes on the present reviewer. Thus, in the course of an analysis of Settlements, irrigation is introduced as a step in the development of agriculture and much is said about it, but no word appears to relate it to the geography of agricultural lands, the best of which impose the labor of clearing the forest. "Irrigation," says Penck, "is the easiest way to introduce agriculture for it avoids the difficult task of clearing the forest"; and so agriculture, New and Old World alike, begins in the semi-arid.

How does man occupy the earth and how does the earth guide his movements? Man is the variable, Earth the constant in all the formulæ—is a note that recurs. The Indian lives in wretchedness in the same American landscape where the Anglo-Saxon is prosperous and has leisure. The Tropics could support a dense population but tropic man rests when his labors have procured him bare sustenance. "The domination of the tropics by the races of the Temperate Zone is a necessity for humanity and will be more so as the World's inhabitants become more numerous" (p. 160). The white man is needed to make the black man work. "Civilized man is a product of his environment and his own powers of work."

Attention is called to two groups of dense population in west Europe and southeast Asia, containing two-thirds of Mankind on a tenth of the Earth's surface, while a great strip of nearly empty desert lies between, from the Sahara across Central Asia. North America has a group of some density in the south-

east, South America only strips and patches of a population that is thin at the most.

Of the races which are classified as straight and curly haired, the "Germans" are limited to the parts of the earth beyond the tropics, the Mediterranean people to the tropics and belts close to them, but the American-Mongolian group thrives from pole to equator. Also, whatever selection has done to man, this race preserves its color, cheekbones and hair in every climate. Probably the characters are very old.

Life spread from North to South. Man appeared in America in the Pliocene (Becker, p. 82). Among the great languages, English is seen to be fitly a "world language for trade and intercourse" (p. 102). Linguistic, political and religious groups are described as facts. No claim of geographic character is made.

Permanent settlements come later than fishing and hunting. Fishing often encourages a fixed abode. Nomadism does not necessarily precede agriculture, but does imply private property in tent and flocks at a time when the land may not be regarded as property. We know nothing of how primitive man lived (p. 123). We can never know whether men had developed speech before they separated (p. 127). Pottery was not known to man before the races separated for the Polynesians knew nothing of it (p. 127). Fire, weaving and the making of tools of bone or stone were known at the start.

Division of labor appeared with agriculture, but some agriculture accompanied even hunting and the labor was divided. There are occasional notes of geographic connection. Early agriculture must have had its beginnings in sheltered nooks among the mountains and not on the exposed open plains. Probably the sites were those where hunting and fishing were not good (p. 152). Agriculture is supposed to originate in the casual germination of stored up fruit and grain. In the Tropics, nature offers so little resistance to agriculture that man gains little power of overcoming it. Europe had to wait for its full agricultural use for men who had acquired great powers of overcoming resistance.

Garden culture with irrigation is the type of agriculture that supports the greatest independent populations, as in Asia. Extensive agriculture, using much knowledge of plants and machinery, is developed only in Europe; America and Australia have hardly begun! Such notes of European complacency are rare in the book, and China is often rated high, as in the case of the wheelbarrow, built by the Celestials so as to take the load on the axle and not in the "stupid" European way.

The account of horse, ass and mule is interesting, as also the account of transportation up to steam, which is barely touched for land or sea, save to say that the latter has less modified earlier methods than the locomotive.

Place locations are put by the author in closer relation to features of the earth. Berlin is at a narrowing of the river at an island with high shores making the best crossing over what elsewhere are marshes. Similarly Cologne is at the last high bank along the Rhine. London is said to be rather a reloading place for sea traffic than a point where land traffic and sea traffic meet. Richthofen does not seem to perceive that cities of the magnitude of even Paris or Berlin grow up only on plains of considerable extent.

Sea ports are best at the head of bays that reach into the continents. Bombay is a great port, Calcutta too, and supported by the great river on which it stands, but the author says nothing of the populous *plains* of that river and how

they back it up. The book is a great collection of interesting items that figure in geography and many of them are shown to be related to the earth.

MARK JEFFERSON.

Tahiti. Memoirs of Ariitaimai e Marama of Eimeo Teriirere of Tooarai Teriinui of Tahiti Tauraatua i Amo. 196 pp., and Map. Henry Adams, Paris, 1901.

How is it that the interesting memories of Ariitaimai, of the best blood of Tahiti, daughter of the high gods, after all these years have come to light in English and from Paris. Only at the climax of her life do we find any recognition of the work of an assisting hand, and then only so much as may be implied in the single sentence "I repeat it in my own words which are more lifelike than any that an editor could use."

A quarter of a century ago Mrs. Salmon was the most interesting figure in the eyes of all such as sought to know more of Tahiti than could be seen along the Broom Road or in the gay glitter of Papeete. She was the last of a great race, the greatest race of her folk, the one survivor of four lines of masterful chiefs. Not in Tahiti was there a mate for her, she chose an Englishman and never regretted her choice, and her son Tati Salmon carries her nobility undiluted. To those for whom she chose to permit acquaintance to be warmed by courtly intimacy she was a mine of information as to the present and the long past of her people. Those who have had the pleasure of hearing her words will be disappointed to find that with her the pen is far short of the tongue.

The most instant value of these memoirs lies in the check upon the blunders of the early voyagers. Beginning with Wallis and the discovery of Tahiti in 1767 she brings names to the correct spelling, yet there are many which have evaded even her ingenuity. However this is not the case with Wallis's "my princess, or rather queen" whose name he never knew, although he was dissolved in tears at their parting. Cook discovered her to be Oberea, and Mrs. Salmon is in a position to give her name truly, for she was her aunt Purea. If for nothing else the work would be valuable as enabling us to elaborate a series of satisfactory footnotes to Cook, Forster, Hawkesworth and the missionary voyage of the Duff. This holds good beyond mere names, the good lady explains much that was a mystery to the early voyagers.

But Ariitaimai supplies a greater puzzle of her own. Mrs. Salmon was very wise in the lore of her race, she was a library of tradition and genealogy. On the other hand the writer of these memoirs is at fault in all the history which is not set down in print in foreign works. At the beginning of chapter xv it is written: "but as I come to the dark ages of our history, between 1800 and 1815, I find a want of records and traditions that shows how narrowly our family must have escaped the fate of almost every other chiefly race." The gap is in the European accounts of Tahiti, the period in which the London missionaries had fled for life; such a gap can scarcely be conceived to exist for the Mrs. Salmon known to us. It is hard to understand.

The frame of mind of the writer of these memoirs is wholly European, the thought is not Polynesian at all, the writer writes of Tahitian affairs as one who comprehends from without imperfectly inward and not as one to whom all these things are known from childhood. This holds good not only of the early parts

of the work but of the final chapter distinctly stated to be "in my own words." We can discover no difference in diction or turn of thought between the two parts.

There is a particular interest attaching to the last chapter, the events of 1846 with which the narrative closes, although Mrs. Salmon lived a long life after that. There are not wanting those in Tahiti who declare her a traitor. Certainly she acted on the side of the French and was the agent of Bruat in securing the surrender of Aimata, the last sovereign of the Pomare title. They had been brought up together as children, but Ariitaimai is at no pains to hide her disdain of such inferior royalty as that of the Pomares with their initial taint of Paumotu blood. Her narrative should be read in connection with the early chapters of Pritchard's "Polynesian Reminiscences." She pays her respects to the elder Pritchard. More gallant or less observant, the junior Pritchard leaves her out of his somewhat envenomed narrative of the same events. Yet it matters little now. It would be vanity indeed to seek to find out verities in the fated downfall before European needs of an impractical South Sea monarchy.

It is a most interesting volume yet one which may not safely be cited haphazard as authority. WILLIAM CHURCHILL.

The Geology of the Whangaroa Subdivision, Hokianga Division. By J. M. Bell and E. de C. Clarke, New Zealand Geol. Survey, Department of Mines, *Bull.* 8 (N. S.) pp. 1-115, 17 illustrations, 8 maps, and 4 geological sections. Wellington, N. Z., 1909.

This report continues the description of New Zealand along lines laid down in the first reports of the series. The division forms the northern part of the mainland of North Island. In the first chapter is an excellent description of the chief geographic features of the region, the fauna, flora, timber, climate, early history, population, industries and means of communication. Of special interest is the description of the Kauri Bush, and the discussion of the various types of vegetation that respond in their distribution and character to the physical geography of the region. On p. 16 is a description of the lumbering methods employed where the rough country and lack of population make ordinary methods difficult.

Perhaps the most curious industry is the gathering of kauri gum that still supports a kind of semi-nomadic population. The gum is dug from almost treeless gumfields where once great forests stood that were probably destroyed by the Maoris. The gum is usually but a few inches below the surface and in the swamps is found at all levels as far as ten feet below. The earth is probed with a spear and when a find is made the gum is either unearthed by digging or is brought to the surface by a hooked spear.

The chief physiographic features may be described as an uplifted and faulted peneplain maturely dissected, and, more recently, slightly depressed. Two erosion levels have been identified, each ancient surface having been to a certain extent masked by lavas and breccias before uplift and dissection began. The various topographic districts to which these events gave rise are discussed in detail. The description of the many interesting shore features is especially full and well illustrated. The greater part of the report deals with the geology of the region with especial reference to the occurrence and development of economic resources.

ISAIAH BOWMAN.

Report of the Mississippi River Commission. Annual Report of the Chief of Engineers, 1909. Appendix PPP. pp. 908-910, 2641-2845. 39 plates. Index. Government Printing Office, Washington, D.C., 1909.

This report of the Mississippi River Commission for the fiscal year ending June 30, 1909, does not differ in any essential degree from the form of the earlier reports.

For the last three years, the Commission has reported the caving at Walnut Bend, 281 miles below Cairo, which threatens to make a cut-off into the St. Francis river (see Figure). This has been prevented up to this time by abattis dikes

WALNUT BEND IN THE MISSISSIPPI.

which, acting as bar builders, cause a deposit of sand to accumulate in the caving bends and thus turn the threatened bank areas into localities of deposit instead of localities of scouring. The Commission gives as the main objection to a cut-off here the expectation that the low-water level of the St. Francis river would in case of a cut-off be raised from 8 to 10 feet and thus inundate much land normally under cultivation.

The low-water stage, autumn of 1908, was lower than it has been for five

seasons, and in addition it was of considerable duration. A stage below 10 feet was recorded on the Cairo guage from Sept. 14 to Dec. 2, with the exception of nine days in November. The low stage continued much later than usual, a consistent rise not beginning until Jan. 18, 1909. At five crossings, less than the depth stipulated for navigation appeared, but the dredges were able to remedy the condition quickly.

The high water of 1909, which came largely from the Ohio basin, was 1.72 feet higher at Cairo than the 1908 flood, but it was of much shorter duration. The river was 29 days above the 40-foot stage at Cairo in 1909, as against 76 days in 1908. At Vicksburg, it was above the 45-foot level 45 days during 1909 and 114 days during 1908. The high water was made dangerous at a few localities by the breaking of severe wind storms during the crest of the flood. The waves thus formed, beating against the levees during a full stage of the river, intensified the wear of the banks.

The Commission reports that the levees are 78.5 per cent. completed and are now protecting 26,569 square miles of territory. The only district completely protected is the Upper Yazoo. The loss of levees during the past year by caving amounted to one and one-fifth per cent. of the entire content now standing. This loss was due to abandonment because of threatened destruction and not to the breaking of the levees. No breaks were recorded.

The report is illustrated by many plates, including the hydrograph for the year. Special mention should be made of the comprehensive hydrograph of the river from 1871 to the present time. The report has an index, a feature which was added for the first time last year. The data of previous reports are rendered almost useless, and especially so because of the arrangement of the material, by the total lack of any guiding words. The introduction of the index is a welcome addition and makes it possible for the student or the lay reader, who is seeking for certain information, which in these reports is generally scattered throughout the volume, to turn quickly to the portions of the report of interest to him.

R. M. Brown.

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British East Africa. British East Africa Protectorate. 1 inch=54 miles. Inset, Plan of Mombasa, 1 inch=3.017 miles. Illustrates Drumkey's Year Book for East Africa, Nairobi, 1909. [Provinces are shown in colors and game reserves are outlined.]

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French West Africa. Côte d'Ivoire. 1 inch=200 kil. With paper "Les Troubles de la Côte Ivoire," by Georges Demanche. *Rev. Franc.* No. 376, Paris, 1909. [Four small black maps illustrating the political situation, 1908-9.]

South Africa. (a) Sketch Map showing the Trionometrical Connection between the previously existing Geodetic Surveys in the Transvaal and Southern Rhodesia. No scale. 20° 15′-22° 15′ S.; 29°-30° E. [Shows triangulation net, streams, mines, etc.;] (b) Diagram of Triangulation in South Africa. 1 inch=29.5 miles. [Gives, in colors, astronomical stations, and the triangulation net in the several colonies;] (c) Diagram of Triangulation for solution of vertical heights; (d) Diagram of vertical section of base lines. [50 fold

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ASIA

China. (a) Colored Chart of China Coast, no scale, showing position of lights and limits of Customs Districts; (b) Nine colored Charts, no scale, showing position and kind of lights. Illustrates "List of Lighthouses, Light-Vessels, Buoys and Beacons on the Coast and Rivers of China, 1910." Imperial Maritime Customs, 111—Miscellaneous Series: No. 6, Shanghai, 1910.

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Austria-Hungary. Dislokation der Österr.-Ungar. Wehrmacht, 1910. 1:1,-800,000=28.4 miles to an inch. G. Freytag & Berndt, Vienna, 1910. K. 4. [Showing the distribution of the military garrisons, marine forces, military hospitals, etc., in the empire in 1910, with explanatory letterpress on the margins.]

Austria. Karte des politischen Bezirkes Hietzing- Umgebung. 1:100,000=1.5 mile to an inch. G. Freytag & Berndt, Vienna, 1910. Heller 20. [A good, cheap hand map for use in the schools of this district.]

Austria. G. Freytag's Verkehrsplan der k. k. Reichshaupt-und Residenzstadt Wien. 1:15,000=1250 ft. to an inch. G. Freytag & Berndt, Vienna, 1910. K. 1. 20. [A first rate plan of Vienna, giving all information needed by the general consultant, including numbers of houses on so many street corners that any person may easily find any residence that he wishes to visit. All details may be read without difficulty. Sheet 2 is a similar map of Floridsdorf, the new ward of Vienna on the east bank of the Danube. The sheets are bound in with an index referring to letters and numerals on the map margins.

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Vienna, 1910. Paper, K. 4. [A good physical and political map with 9 tints for elevations above the sea, rail and wagon routes, mines, ruins, caves, heights in meters, etc.]

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Russia. Diagrams showing commercial movement on the Volga-Neva-Maria Canal, forty years ago and at present. With paper "Commercial Movement in the Volga and Neva Basins during the past Forty Years. By I. F. Borkowski. *Isviestiia* I. R. Geog. Soc., Vol. 45, No. 10, 1909. [Gives ports and illustrates development of steam traffic, volume of freightage and kinds of merchandise transported.]

Russian Empire. Map of Routes in the Russian Empire. 1 inch=450 versts. With paper "Commercial Movement in the Volga and Neva Basins for the last Forty Years." By I. F. Borkowski. *Izviestiia* I. R. Geog. Soc., Vol. 45, No. 10, 1909. [Colors show water and rail connections in the Empire and their relation to routes in adjacent countries.]

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United Kingdom. L'Église catholique dans les Iles britanniques. 1:1,280,000=44.19 miles to an inch. Supplement to *Les Missions catholiques,* 1910. [Upon an excellent map of the United Kingdom, with hill features in brown, many heights in meters, railroads, etc., are imposed, in red, the seats of archbishops and bishops and the boundaries of dioceses. All places shown on the map have at least one Catholic church.]

OCEANS

INDIAN OCEAN. (a) Monatskarten des Luftdrucks. [12 black charts on one sheet giving isobars over the Indian Ocean for each month in the year;] (b) Monatskarten der Lufttemperatur. [Isotherms for each month;] (c) Monatskarten der Oberflächentemperatur. [Surface isotherms for each month.] Illustrates paper "Monatskarten des Luftdrucks sowie der Luft und Wassertemperatur für den Indischen Ozean nebst angrenzenden Gebieten," *Annal. d. Hydrog. u. Maritim. Meteorol.*, No. 4, 1910.

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BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY

Vol. XLII 1910 No. 7

STUDIES ON CLIMATE AND CROPS*

2. THE YIELD OF WHEAT IN THE UNITED STATES AND IN RUSSIA DURING THE YEARS 1891 TO 1900

BY

HENRYK ARCTOWSKI

The following figures† show, in millions of bushels, the wheat crops in the United States and Russia for the years 1891 to 1905. The diagram (fig. 1) simplifies the comparison of these figures.

	1891	*1892*	*1893*	*1894*	*1895*	*1896*	*1897*	*1898*	*1899*	*1900*	*1901*	*1902*	*1903*	*1904*	*1905*
U. S.	611	515	396	460	476	427	530	675	547	522	748	670	637	552	692
Russia..	278	356	478	465	413	412	340	459	454	422	427	607	621	666	636

By this diagram we see at once the extremely interesting fact that during the years 1891 to 1897 and 1901 to 1905 the variation in the values for Russia and the United States is just opposite, while during the years 1897 to 1900, on the contrary, the two curves are similar, the quantity of crops increasing and decreasing simultaneously in the two regions. This fact leads us to the following suppositions:

1. That the variations in harvests are such that very bad years in one region of the globe are precisely years of excellent yield in another region; 2. That the centers of compensation are not always to be observed in the same regions; it does not necessarily follow

* Paper 1 in this series appeared in the April BULLETIN, pp. 270–282.

† I. M. Rubinow: Russian wheat and wheat flour in European markets, p. 15, Washington, 1908 (U. S. Dept. of Agric., Bur. of Statistics.—*Bull.* 66).

that when the crop yield is large in the United States it is small in Russia, or *vice versa;* 3. That to meet the needs of the international market there may be exceptional years of insufficient compensation.

My argument is that these suppositions are well founded. I also admit that a close connection exists between agricultural and climatic variations, and that, in the final analysis, changes in the

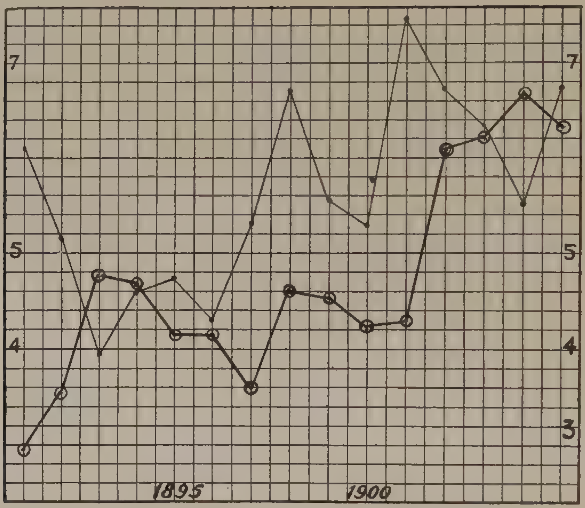

FIG. 1.

quantity of energy radiated by the sun and received by the earth are, most frequently, the cause of temporary increase or decrease in prosperity in different regions of the globe.

Before proceeding further I wish to make two remarks. I must draw attention to the fact that my method of discussing the problem of the influence of the variations of solar phenomena on the yield of crops is quite different from that of W. S. Jevons, Sir John Eliot and others; and then, that the great importance of the influence of climatic variations on crops is far from being recognized by the most competent specialists on the subject.

One of the final conclusions of Professor Cleveland Abbe's report on the relations between climates and crops reads:* "... the yield per acre for any one of the ten principal crops . . . has probably never been either increased or diminished by 50 per cent. of

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*Cleveland Abbe: First report on the relations between climates and crops, p. 364, Washington, 1905 (U. S. Dept. of Agriculture, Weather Bureau, *Bull.* No. 36).

the normal yield per acre by climatic influences alone over any large region, such as 100 square miles; and, further, the total annual harvest for any given crop in the United States is not likely to be diminished 5 per cent. by the occurrence of an inclement season in some one portion of the country."

At present I could not discuss the question of the climatic influence on the yield of crops in all its details. It is sufficient to look through Professor Abbe's report to see how difficult this question is. But it seems to me that the first work to be done, preparatory to discussing the problem, is purely geographical, because, in order that it may be possible to learn for what regions (and for what years) the meteorological conditions should be especially studied, from month to month, we must know the geographical distribution of excess and deficit in the yield of crops.

Such is precisely the object of this paper.

Now, coming back to the wheat crops in the United States and in Russia, we must observe that, taking into consideration the increase in population and the improvements in agriculture, it is easy to understand why the two curves of my diagram must ascend, and, from that fact, one must admit that the sudden falls of the curves are due to natural causes, independent of the will of men or needs of the market.

Now, in the United States the production of wheat fell off, during the years 1891 to 1893, from 611,780,000 to 396,132,000 bushels, a difference of 215,648,000.

The same is noted from 1898 to 1900, and from 1901 to 1904 the decrease was quite as characteristic.

In Russia the curve descends from 1893 to 1900, and the contrast in the values of the years from 1902 to 1905 with those of the preceding years is very marked. To have comparable figures, and independent of the areas of soil used for agricultural purposes, it is necessary to consider the yield per acre. Notice now, that a decade of years is a period of time not long enough to have the figures much influenced by agricultural improvements, which would increase the yield of crops, and that the soil, in a region of new colonization, cannot be exhausted to any great extent in ten years. In consequence, it seems to me that instead of comparing the yield per acre from one year to the next, and from one region to another, it is just as well to consider the annual departures from the means of a period of ten years.

For example: the yield per acre in the State of Maine in 1891 was 16.3 bushels, in 1892, 16.7, &c., and the mean for the years

1891 to 1900 is 18.9. I can write therefore −2.6 for 1891, −2.2 for 1892, &c. These figures of deficit or surplus of bushels per acre can be used to draw maps.*

The figures utilized to establish the annual departures for the different States of the Union are those given by Charles C. Clark.† The figures for the provinces of Ontario and Manitoba are taken from Canadian official publications.‡ As the departures are written on the following maps (figs. 2–11) it is unnecessary to reproduce them in tabular form.§

To simplify the examination and comparison of the maps I have drawn curves of equal departures. In this way the areas of deficit and surplus can easily be distinguished.

From the examination of these maps it may be inferred that the two first hypotheses expressed on the subject of compensations are correct. For, looking at the geographical distribution of the departures, one must acknowledge that centers of exceptionally good or bad harvests really exist, that the extent of these areas is generally much smaller than the extent of the United States, and also, that the points where the most favorable or the most unfavorable conditions are centered, displace themselves, and that, in reality, we have to do with a phenomenon of a dynamical order.

The maps of the years 1893 and 1898 should be examined to begin with.

The wheat crop was bad almost all over the United States in 1893, while in 1898, on the contrary, the harvests were above the average, one may say, everywhere. But, in both cases, the values of the figures are disposed in such a fashion that we are bound to admit that the factors upon which the crops depend proceed by waves. In 1893 the figures — 7.3, — 7.2, — 7.6 for the States of Nevada, Utah and Colorado occur along a line at the end of which we observe the departure — 4.3 in Kansas, and farther on, — 1.2 and — 1.3 in the States of Arkansas and Mississippi. Beside this negative wave, there is one of positive values extending from North Carolina to Indiana, and on the prolongation of this wave we note,

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* The average yield being quite different from one region to another (the extreme means for the ten years 1891 to 1900 are 7.2 for South Carolina and 25.2 for Montana), it would be well to correct the departures by calculating them in per cent. of the average yield. I used the uncorrected departures in making my maps.

† Wheat crops of the United States, 1866–1906. (U. S. Dept. of Agriculture, Bureau of Statistics —*Bull.* 57, Revised.)

‡ Nineteenth Annual Report of Ontario Bureau of Industries, p. 25.
Statistical Year-Book of Canada, 1900, p. 79.

§ The maps show that the departures for Vermont must be considered as being doubtful

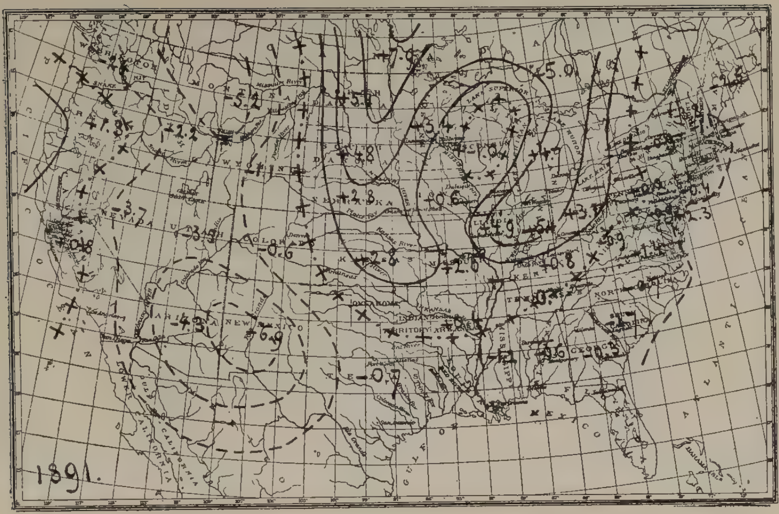


Fig. 2.

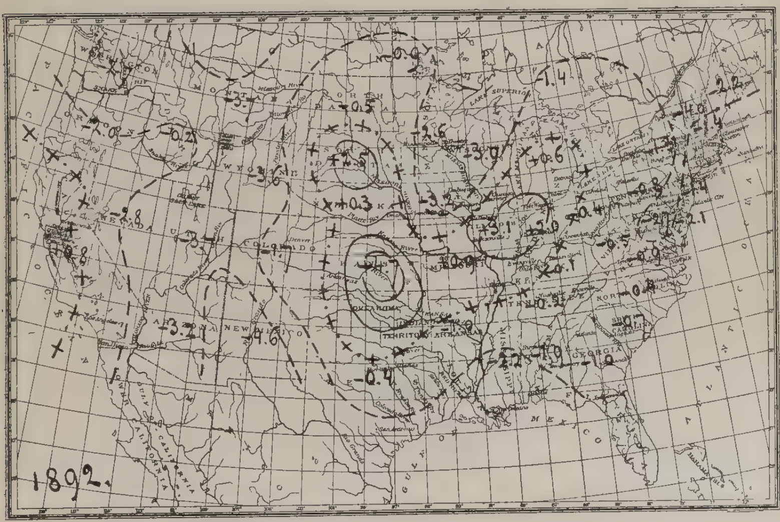


Fig. 3.

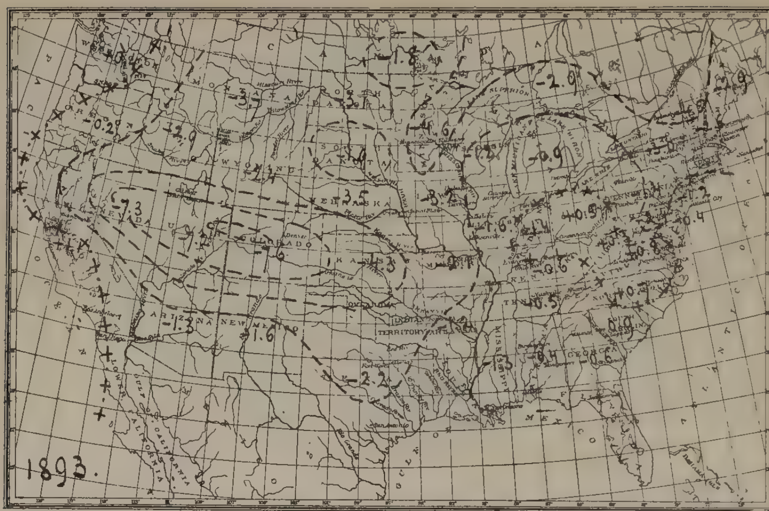


FIG 4.

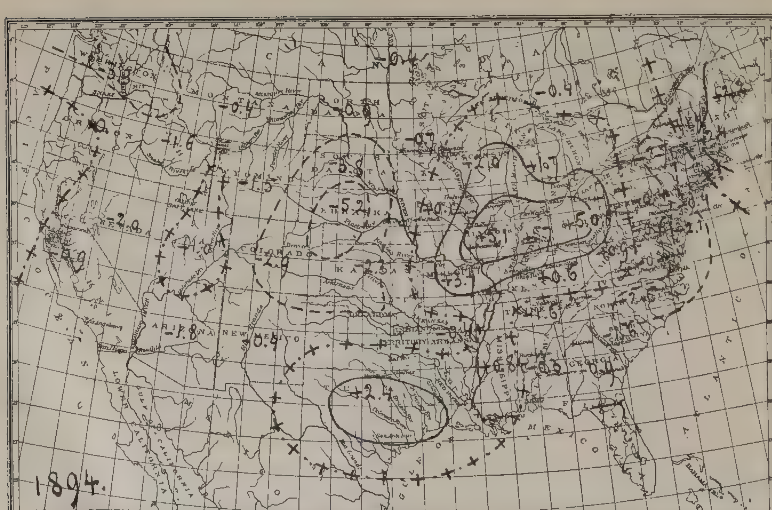


FIG. 5.

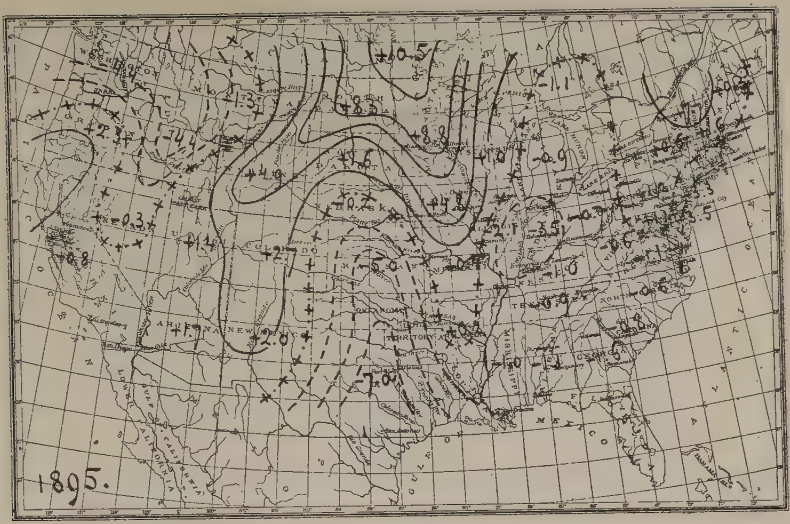


FIG. 6.

FIG. 7.

FIG. 8.

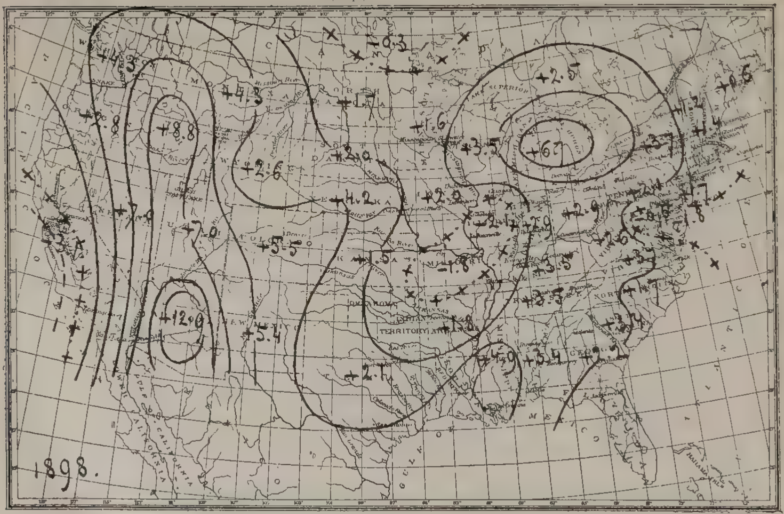


FIG. 9.

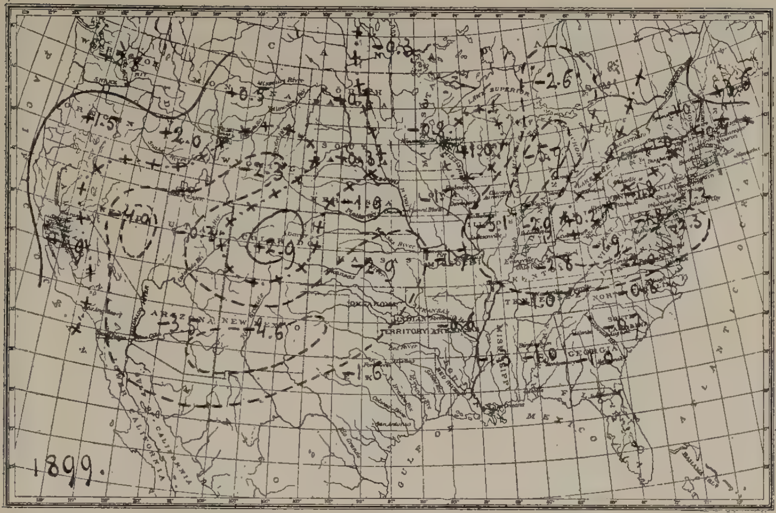
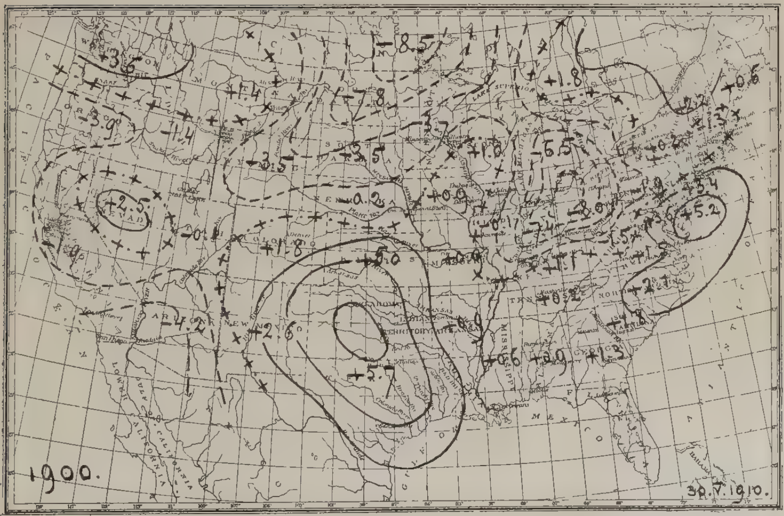


FIG. 10.



H. A.

FIG. 11.

in South Dakota, the departure — 1.9, which is less negative than those in the neighboring States.

The map of 1898 is still more curious. The excessive value of +12.9 bushels per acre in Arizona is followed by +7.0 in Utah and Nevada and +8.8 in Idaho; more to the north the crest of this positive wave extends into Canada, since the departures in Montana and Washington State are +4.3. Another positive wave, less distinct, however, extends from the Gulf of Mexico to the Great Lakes, and between these two waves of excessive crops we find values below the average, −0.3 in the Province of Manitoba, and −2.1 and −1.8 in Illinois and Missouri.

It seems to me that these phenomena could not be explained by local causes, independent of the anomalies of meteorological conditions, and that the study of the climatical changes, on the contrary, shall supply a scientific explanation of these facts. Now let us compare the maps of successive years. Those of 1891, 1892 and 1893 show some interesting points of resemblance. The positive area of 1891 extends from Canada to Arkansas. In 1892 this area diminished in extent, and the center of highest positive value moved from Manitoba to Kansas, and instead of +7.9 it is +4.7 that we note. In 1893 there are still positive departures, but only in a small portion of the country, and the highest value (Indiana) is reduced to +1.4.

Thus: a decrease in extent and a displacement in the opposite direction to the hands of a clock. The negative wave stretching, in 1891, from Montana to Mexico, seems to have followed the same movement. A really curious fact to be remarked is, that I noted exactly the same movement on the maps of annual departures of temperature.* I do not insist on this detail as the question of the correlations between crops and the dynamical phenomena of climates must be fully studied, point by point and progressively, step by step. However, two facts are at present sufficiently well established to attract our attention.

First, the areas occupied by positive or negative departures on the maps of annual data of temperature, atmospheric pressure, and yield of wheat are comparable in extent. The same fact is shown in a series of maps I have drawn for the departures of rainfall observed in the United States.† Then, the disposition of the

* Arctowski: L'enchaînement des variations climatiques, p. 105, Brussels, 1909.

† This research will form the subject of a special paper. The utilized data are those published by Frank H. Bigelow (U. S. Dept. of Agriculture, Weather Bureau, Climatological Division, Abstract of data No. 3).

The departures which I have utilized to draw the maps have been calculated in per cent. of the normal values, exactly in the same way as H. R. Mill has done for the rainfall maps of Great Britain and Ireland. (British Rainfall, 1908.)

thermopleions and anti-pleions of my maps of annual temperatures forced me to admit the existence of waves which displace themselves. In my preceding paper* I have shown that for atmospheric pressure the same thing most probably exists. As the maps of wheat crops give similar indications, it is reasonable to admit that the crops depend on the same atmospheric changes as those which cause the appearance and propagation of thermopleions and anti-pleions, as well as hyper- and hypo-pressure areas. I have already insisted upon the waves which appear on the maps of 1893 and 1898. I wish to add some words about those of the other departure-maps of wheat crops which are sufficiently well marked to be worthy of mention.

The positive wave which, in 1894, extends from the Great Lakes to Texas, shows two centers of excessive positivity, very lightly joined. A third nucleus of excessive crop appears on the extension of this wave towards the NE. In Nebraska a departure of — 5.2 counterbalances that of + 5.7 of Indiana.

The map of the following year looks as if there had been a displacement towards the W. with an accentuation of positivity. In this hypothesis the departure + 10.5, of Manitoba, would be due to the surplus center + 5.7 observed in Indiana in 1894. The maps of 1897 and 1898 show a case of exactly the same kind and quite as interesting. The positive wave extending from Montana to New Mexico, in 1897, is seen the following year a little farther to the W. At the same time the positive wave of 1897, the crest of which is directed from Lake Huron to Cape May, followed this movement, going to the NW. The transformation of the map of 1899 into that of 1900, if any connection does exist between the two maps, can only be explained, it seems, by a northwesterly displacement. Moreover, if the map of 1899 but slightly suggests the existence of two systems of waves, directed from the NE. to the SW. and from the NW. to the SE., that of 1900 shows these intercrossing waves so clearly, that one must be prejudiced not to admit their existence.

Let us see now how things went on in Russia and Central Europe.

From the data of a paper by I. M. Rubinow† and those collected

* *Bull.* of the Amer. Geogr. Soc., vol. 42, p. 270.

† I. M. Rubinow: Russia's wheat surplus, p. 29, Washington, 1906. (U. S. Dept. of Agric., Bureau of Statistics—*Bull.* No. 42.)

by Frank R. Rutter,* I have formed the means and the departures of the means shown in the following table:

REGIONS.	MEAN.	*1891.*	*92.*	*93.*	*94.*	*95.*	*96.*	*97.*	*98.*	*99.*	*1900.*
	Bush. p. acre:										
Centr. agric. region....	9.0	—5.4	—4.1	+2.5	+2.9	+3.6	—1.2	—3.5	0.	+1.8	+3.1
Middle Volga.........	6.8	—3.8	—0.9	+0.1	+2.7	—0.8	+2.8	—1.3	—1.8	+2.5	+0.9
Lower Volga..........	7.1	—4.7	+2.8	—1.0	+2.9	—0.2	+1.5	—1.8	—1.8	+0.3	+2.2
New Russia...........	7.7	—2.1	—1.5	+5.1	+2.0	+0.6	—0.6	—1.3	+1.8	—1.9	—1.5
Little Russia..........	9.6	—2.4	—2.9	+2.0	+1.8	+1.9	—1.3	—0.8	+2.6	—0.1	—0.4
Southwestern region...	13.1	—3.1	—3.3	—1.4	+3.0	+2.9	+2.1	—4.8	+3.9	+4.5	—4.0
Ural................	10.3	—6.1	—1.5	—1.6	+1.9	+0.3	+2.9	+0.1	—0.8	+3.2	+2.1
Moscow industr. region.	8.9	+0.5	—1.4	—0.5	+0.7	—0.4	+0.5	+0.5	+0.8	+1.3	—2.8
White Russia..........	10.4	—0.7	+0.5	+0.1	+0.4	—1.5	—0.4	—1.4	+1.9	+1.3	—0.3
Lithuania............	11.3	—1.5	—0.9	+0.8	—0.3	—1.0	0.	+0.3	+1.9	+1.2	—0.5
Baltic region..........	15.7	—0.8	—5.0	+0.5	+0.6	—3.2	+0.7	+0.5	+2.4	+3.4	+1.3
Sweden	24.8	—0.1	—0.2	—2.5	+0.1	—3.7	+1.9	+1.5	+0.4	—0.4	+3.2
Roumania.............	14.6	—1.9	+2.7	+4.3	—1.9	+4.7	+4.5	—5.4	+1.7	—8.3	—0.2
Germany..............	25.2	—6.8	—1.4	—0.4	—0.2	—0.8	+1.2	+0.1	+2.0	+3.2	+2.7
Hungaria..............	17.9	+0.5	+0.6	+1.6	+0.3	+2.8	+1.5	—6.2	—0.8	—0.1	—0.6

I have put these figures on maps in order to get a clear idea of the geographical distribution of annual surplus or deficit of the crops of wheat. These maps are much less detailed than those of the United States, where 44 departures could be utilized each year. I do not reproduce my drawings because later I hope to obtain the necessary data to make detailed maps, which will in consequence be more accurate. Therefore I shall restrict myself at present to a few statements of a general order.

In Russia, as in the United States, there are no regions which could be considered as being the permanent centers of the observed variations. It is not always the same provinces of the Empire which are the most or the least favored. So it seems that in Europe, as in America, the zones of surplus and deficit displace themselves. However, the variations are more accentuated as the distance from the ocean increases. It is in the south of Russia and toward Asia that the changes of the crops are most pronounced. The greatest difference in the annual yield of wheat per acre, for the ten years taken into consideration, is 6.9 in Sweden, where the average is 24.8. In the lower basin of the Volga (provinces of Samara and Astrakhan), where the annual yield is only 7.1, that is to say less than the third of that of Sweden, the difference between the values of the years 1891 and 1894 reaches 7.6 bushels per acre, a fluctuation which is therefore four times greater than that observed in Sweden. In Rumania also the difference between the greatest departures is 13.0 for an average crop of 14.6.

* Frank R. Rutter: Cereal production of Europe, Washington, 1908. (U. S. Dept. of Agric., Bureau of Statistics—*Bull.* No. 68.)

Let us examine the geographical distribution of the departures for the years 1891, 1893 and 1897, that is to say the years for which the total production of wheat in Russia is most strikingly in contrast to that of the United States.

In 1891 the yield of crops did not surpass the average of the ten years except in the "industrial region" of Moscow (provinces of Tver, Moscow, Kaluga, Yaroslaw, Vladimir, Kostroma). A positive departure was also observed in Hungary, but there, as well as in the region of Moscow, the excess was only + 0.5. In Germany the negative departure was — 6.8, and in the central agricultural region of Russia and in the E. and SE. of the Empire the departures are, all proportions maintained, still more negative. The figure — 0.7, for White Russia, indicates that the two centers of very bad crops in question were separated by a wave of better yield of crops, by a wave directed from the region of Moscow towards Hungary.

The geographical distribution of the departures for 1893 shows the existence of a wave which crosses the Russian Empire in a perpendicular direction to that of the positive wave of 1891, inasmuch as the figures permit a judgment. It is in Rumania and in southern Russia that the most positive departures are observed, and then, it is from the Don and the Volga towards the Baltic Provinces that the wave in question extends, separating the regions characterized by a deficit in crops. On this point it is interesting to notice that the negative wave of 1893, in the United States, followed also an almost perpendicular direction to that of 1891.

In 1897 the boundary line between the positive and negative departures, in Russia, extends from E. to W., from the Ural towards Germany. The crops are a little above the normal value in the N. (in Sweden even + 1.5 per acre), while in the S. they were very bad, especially in the SW., and in Hungary and Rumania, as well as in the central agricultural region (provinces of Riazan, Tula, Orel, Kursk, Voronezh, Tambov) where a second center of deficiency is observed. A comparison with the United States leads to very suggestive conclusions.

As an hypothesis, I may venture to say that on both sides of the Atlantic, across North America and across Europe, and perhaps even Asia, a common factor of dynamical order governs simultaneously all the variations.

Notwithstanding the fact that the maps I have drawn for Russia are much less satisfactory than those for the United States, I cannot refrain from adding to the preceding remarks that, in 1898

1899 and 1900, years during which the curves of fig. 1 are not of an opposite character, the maps show certain analogies which are really striking. In 1898, in Russia, the departures are + 3.9 in the W. and — 1.8 in the E. A great positive wave seems to cross Europe from the N. to the S. The American map shows something similar. In 1899, in Europe as well as in America, the values are negative in the S. and positive in the N. The departures of 1900 observed in Russia suggest an intercrossing of waves quite the same as seems to have been the case in the United States.

From the fact that in Russia and in the United States the variations of the figures of wheat crops, for the years 1897 to 1900, are similar, I have deduced the conclusion that, for the needs of the international market, there may be exceptional years of insufficient compensations.

To be convinced of this it is sufficient to examine the price of wheat in England.*

In 1891–92 the price of grain was 101.6 cents a bushel; then the price diminished till 1894–95, when it was as low as 64.8; rose again to 110.3 in 1897–98, then gradually went down to about 80 cents.

GRAIN CROPS AND POTATOES IN THE UNITED STATES, 1891-1900 (IN MILLION BUSHELS).

PRODUCTION OF	*1891*	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*	*1900*
Corn.....	2,060	1,628	1,619	1,212	2,151	2,283	1,902	1,924	2,078	2,105
Oats......	738	661	638	662	824	707	698	730	796	809
Wheat....	611	515	396	460	467	427	530	675	547	522
Potatoes..	254	156	183	170	297	252	164	192	228	210
Barley....	86	80	69	61	87	69	66	55	73	58
Rye......	31	27	26	26	27	24	27	25	23	23
Buckwheat	12	12	2	12	15	14	14	11	11	9
Total...	3,792	3,089	2,933	2,603	3,868	3,776	3,401	3,612	3,756	3,736

Following another idea, the above table gives in millions of bushels the production of corn, oats, wheat, potatoes, barley, rye and buckwheat, for the years 1891 to 1900, in the United States.†

By adding the figures we see that the agricultural production diminished during the years 1891 to 1894 from 3,792,000,000 of bushels to 2,603,000,000, making a deficit of 1,189,000,000 bushels,

* Rubinow: loc. cit., *Bull.* 66, p. 77.

† U. S. Dept. of Agric. Bureau of Statistics—Bulletins: 56, 57, 58, 59, 60, 61 and 62.

which is almost a third, or perhaps more, if the figures were divided by the numbers of inhabitants forming the population of these years.*

It seems to me unnecessary to dwell on the signification of the preceding figures from the commercial point of view. On the other hand, I cannot let pass without comment certain apparent contradictions. The variation of the production of wheat, for example, is notably different from that of potatoes. It is easily understood that certain meteorological conditions favorable to wheat might be unfavorable to the development of potatoes. The same thing is true of corn. R. H. Hooker has made a detailed statistical study of the meteorological conditions favorable or unfavorable to the different crops in England.†

He has found that in England, of course, "the absence of rain in September and October is more important to the wheat crop than rain or temperature at any other period of the year." Another interesting result of Hooker's work is that "the advantage of cool weather during spring and summer for the great majority of the crops" . . . is a "feature [which] stands out with quite unexpected prominence."

It is probable that in other climates conditions are not the same, and it is clear that the influence of each meteorological factor should be studied, region by region and separably, for each particular cereal. The difficulties in the way of foreseeing the yield of crops are enormous. However, this problem can be attacked and its solution is attainable.

I think I have shown that the maps giving the annual distribution of wheat crops are of such a character that, in order to explain them, it is necessary to have recourse to meteorological influences depending on the general circulation of the earth's atmosphere.

The amount of meteorological observations which has been accumulated in the course of years is enormous, and it is perfectly possible, at present, to study scientifically the simpler problems of the climatical changes. I really believe that even if the true connections between the causes and the effects escape us, yet practical results will be obtained by applying purely empirical methods.

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* The increase of the population from 1891 to 1894 was about 3,788,000 (Statistical Abstract of the United States. 1908).

† R. H. Hooker: Correlations of the weather and crops. (Journ. Roy. Statistical Soc., vol. 70, p. 1. London, 1907.)

ASCENT OF MOUNT ROBSON,

THE HIGHEST PEAK IN THE CANADIAN ROCKIES

BY

GEORGE KINNEY

On Friday, Aug. 13, 1909, Donald Phillips and I congratulated each other in at last capturing that most difficult peak, Mt. Robson. We stood on the needle point of the highest and finest peak of all the Canadian Rockies. I doubt if ever a peak was fought for more desperately, or conquered under greater difficulties.

Situated in the heart of the Rockies, some fifty miles or more north of the Yellow Head Pass, and hundreds of miles from civilization, the mountain could only be reached by pack-train after long weeks of strenuous effort, through trackless forest and muskeg, by nameless mountains and raging torrents. I have the honor of being the first white man known to have stood on its rugged sides.*

Dr. A. P. Coleman, Geologist of the University of Toronto, organized an expedition in 1907 to capture Mt. Robson. The party consisted of Dr. Coleman, his brother, L. Q. Coleman, myself and a helper. The four of us, with our pack-train of ten horses and outfit, left Laggan on Aug. 2, 1907. We followed the Pipestone, Siffleur Saskatchewan, and Athabasca rivers; crossing the Pipestone and Wilcox Passes.

For weeks we made our own trails through the wilds, and forced our way through hundreds of miles of tangled underwood. Rafting our equipment over the Athabasca, across which we had to swim our horses, we hurried over the Yellow Head Pass, and swung down the Fraser. But our trip that year left Mt. Robson still unconquered, though we explored its western side, and I discovered Mt. Turner and the "Valley of a Thousand Falls."

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*Mr. James McEvoy of the Canadian Geological Survey, who described this region in the *Annual Report* of the Geological Survey of Canada (Vol. XI, 1898), says that the top of the mountain is usually completely hidden and rarely is it seen entirely free from clouds. The actual height of the peak is 13,700 feet, or 10,750 feet above the valley. The face of the mountain is strongly marked by horizontal lines, due to the unequal weathering of the rocks, and has the appearance of a perpendicular wall. From the summit to the base, the slope is over 60° to the horizontal. Mr. McEvoy adds that, though the mountain had long been known, its height had never been determined nor was it thought to be conspicuously notable in elevation; but since the heights of Mounts Brown, Hooker and Murchison have been proved to be greatly exaggerated, Mount Robson has the distinction of being the highest known peak in the Canadian Rockies. Mr. Kinney is a clergyman.

The three of us renewed our attack in August, 1908. This time Dr. Coleman secured John Yates, an experienced packer, to take us in charge. Going in by way of Edmonton, we followed very nearly the route the Grand Trunk Pacific is now taking, crossed the Yellow Head and followed down the Fraser as far as the Moose River, a tributary of the latter. This time we attacked Mt. Robson from the East side, by tracing the Moose River to its source and then a branch of the Smoky. The story of our fight for the peak that fall, is briefly told in the *Canadian Alpine Journal* of 1909.* The region for miles around the splendid peak was explored, and many peaks all about it were ascended. The mountain itself was attempted on several occasions, but the difficulties were so great that we had to give up, after spending twenty days at its foot.

I left the mountain that fall, believing that I had made my last attempt to climb it. But in the spring of 1909, Mt. Robson had still such a hold on me that I could not rest satisfied till I had made another attempt. I then made arrangements with John Yates for another trip, and planned to reach Mt. Robson several weeks earlier than the year before. In May I received word that foreign Alpinists had designs on Mt. Robson. Telegraphing Yates that I was starting at once, and expected to meet him on the trail, I left Victoria on June 2, for Edmonton to outfit an expedition of my own. I had counted on one of my brothers making the trip with me, but, at the last moment, he could not get off. I was in Edmonton about a week before I finally got my outfit together. This delay cost me dear, for I was caught in the floods of the Athabasca. Another disappointment awaited me in Edmonton for a letter from Yates told me it would be utter folly to think of starting on a trip to Mt. Robson at that time, because the very late spring had left the mountains and passes full of snow. But I had gone too far to back out then, and snow or no snow, I decided to make the attempt.

On Friday, June 11, with only $2.85 in my pocket, but with three good horses packed with three months provisions, I started off alone for Mt. Robson, hoping to pick up some one on the trail who would share fortune with me. But for hundreds of miles across the prairies and through mountain fastness I fought alone the great diffi-

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* An editorial note in the article referred to says that the leading feature of this second attempt to ascend Mt. Robson was the plucky and desperate climb made by Mr. Kinney alone when he spent a night on the mountain. "He would have spent a second night but for a promise to his companions to return. The succeeding day was fine, and had he remained he would undoubtedly have reached the summit and made the first ascent of this noble peak, a conquest he richly deserved."

FIG. 1.—MT. ROBSON FROM THE EAST.

Two miles of glacier ice in foreground. It was up this side that Dr. Coleman's party, in 1908, and the British Alpine Club Expedition, in 1909, toiled in vain for the summit.

culties of the trip, threading my way across treacherous bog, or swimming my horses across mountain torrents.

On the MacLeod River, I picked up an old-timer, who wanted to go along with me. Selling him one of my horses and half of my provisions, we shared together for a few days, the joys and hardships of the trail. But the dangers of the trip, and the floods of the Athabasca were too much for him so he dropped out and I was alone again with only two horses.

I nearly lost my whole outfit in the swollen Rocky River, and my saddle-horse and I had to swim for our lives. Then a cloud-burst flooded the whole valley of the Athabasca beyond anything ever known in those parts before, leaving me stranded on a little island and my horses on another. On that occasion I had to shift camp three times, wading waist deep through the raging waters, carrying my provisions and outfit on my back to a place of safety. The floods not only made the rivers impassable, but also the small streams as well, so that I had to make a trail over the mountain sides. When I reached John Moberley's (a half-breed's place), where I expected to swim my horses across the Athabasca, I found several parties of Indians and prospectors held up by the floods. That night the Indian dogs stole all my store of bacon, and to make matters worse, the Indians had no pemmican and all I could buy to replace my stolen meat was a can of lard.

It was here that Donald Phillips rode into camp wearing on his hat the silver badge of the Guides' Association of Ontario. A sturdy youth of twenty-five, he was looking up the country for future guiding purposes, and I soon had him interested in Mt. Robson. He was on his way back for provisions and had his camp on a little island, half a day's ride down the Athabasca, where he, too, had been caught in the floods. Phillips and I swam our horses back to his camp and got things together, so that the next day, leaving behind us Indians and prospectors, who claimed that we would find the trails impassable for another week, we swam our horses across the Athabasca and entered the Yellow Head. From Swift, an old-timer near there, we obtained some more provisions, and then we left the Athabasca.

I found in Phillips a very prince of the trail. Quick, handy, a splendid cook and bubbling over with good nature, he made a campmate that could not be excelled. Never in all the hard days that followed did he utter a word of discouragement, or falter in our undertaking, and though he had never climbed mountains before that

summer, he proved to be a cool-headed and cautious climber. I have seldom seen his equal.

We reached Mt. Robson from the East and camped at tree-line on its north shoulder. Here the Grand Forks, flowing from the big east glacier and Berg Lake, which I discovered and explored in 1908, plunges in a mighty cataract into the "Valley of a Thousand Falls."

We made our permanent camp and turned our horses loose to fatten for three weeks on the sweet mountain grasses. The next day being Sunday we rested. This was July 25, 1909. From where we camped, Mt. Robson rose in one sheer unbroken wall from base to highest summit, and at such a fearful angle that a snow cornice, breaking off the peak, would fall 7,000 feet before it could come to a stop. Yet we spent no time looking for a chance to climb, for I knew of a narrow, rugged way up those walls of rock and crumbling ledges that I had found the year before.

On Monday afternoon, with fifty pound packs on our backs, we worked our way up the cliffs and narrow ledges of that north shoulder of Mt. Robson, till we reached the big shale slope on the north-west side of the mountain, at about 9,500 feet. There in the shelter of Island Cliff, an isolated wall of rock on the shale slope, we spread our blankets and watched the setting sun paint a wonder-world with its glorious colors. We called that spot Camp "High Up." At sunrise the next morning we started for the peak.

The year before I had crossed that shale slope alone to a big shoulder of cliff, nearly a mile to the south, and then, in a blizzard, had climbed some 500 feet of cliff, till my aneroid read 10,500 feet. The storm was so thick that I could see no distance; but from photographs that I had taken of the western side, I believed it possible to make the peak, if that shoulder on the west could be climbed.

But when Phillips and I stoood on the shale slope, and looked at the rugged cliffs above us, we believed, by working our way up its snow-filled couloirs, we could reach the peak quicker than by going around to the south according to our first plan.

This west side of the mountain we found free of snow to about the 11,000 foot line; but the cliffs above the shale slope were more difficult than we had imagined, and it was slow work. The snow in the couloirs, which we had thought would offer good climbing, was so steep and hard that it could only be ascended by means of laborious step climbing. From early morning, till 3 o'clock in the

FIG. 2.—MT. ROBSON FROM THE NORTH.

Kinney and Phillips camped four nights on this side among the cliffs above the snowline. Their dash for the peak was made from Camp "Highest Up," on the high west shoulder, on extreme right. In the foreground, the Grand Forks leaps a 200 feet precipice and begins its journey through the "Valley of a Thousand Falls."

afternoon, we struggled up that wall of rock and ice, and in all that time we succeeded in reaching an altitude of only a little over 11,000 feet. The weather was glorious, and the scenery of this show spot of the Alpine world beggars description. The warm sun kept the avalanches busy all about us, and loose rocks often whistled past us. Sometimes they came from cliffs so high above us, that without any warning, and issuing seemingly right out of the sky, they would scream past us in awful flight to be engulfed in the silence below. We could hear them strike nothing, either coming or going. In descending, that afternoon, we discovered a far easier way up than the one we had tried, so we determined to utilize it on our next attempt.

Returning to our "High Up" camp, we cached blankets and instruments, and then hastened to our permanent camp at the base of Mt. Robson, for more provisions.

On Wednesday, July 28th, we again climbed the cliffs of the north shoulder, but made our "Higher Up" camp that night, in the cliffs above the shale slope at 10,000 feet above the sea. Here we slept on a little ledge so narrow that there was only room for the two of us to lie close together, and we had to build a little wall of stone, to keep us from rolling off the mountain-side.

Though the weather was fine that night, we were very cold, and the wind, at that altitude, was terrific. All the peaks for hundreds of miles were below our level, excepting Mt. Turner on the north, a fine 12,000 foot peak on the other side of the "Valley of a Thousand Falls" from us. The grinding avalanches and the distant roar of countless water-falls, sang our lullaby. We had carried some dry wood with us and were able to warm over a stew of wild meat for breakfast; then in the crisp early morning of July 29th, we tried for a second time those rugged walls of the northern face of Mt. Robson.

So successful were we, that by 9:30 A. M. we had reached an altitude of 11,000 feet where we came to an unscalable wall of rock. Our only possible way to circumvent it was up a slope of ice, 60° or 70° from the horizontal. The ice terminated in a jagged crack in the wall, where we had to climb some 25 feet straight up in the air. It took us so long to cut steps up that great slope of ice, and the ravine was so difficult that it was noon before we conquered them.

But above, we found every possible lodging place loaded with snow, making our climb not only more difficult but adding danger as

well. The sun swinging round to the west brought a new enemy. The snow on the sheltered cliffs began to melt making our footing on them exceedingly treacherous; and not only were little streams forming in every draw and couloir, but loosened masses of rock and ice began falling on every hand.

We reached an altitude of over 12,000 feet, and our worse difficulties seemed nearly over, but the day was too far spent for us to make the peak and ever get back to safety, so reluctantly we turned back.

For more than 1,000 feet down those upper cliffs of rock our every step was fraught with fearful danger. Not only did we have to descend gullies dripping and streaming with water, where falling rock and avalanche were a constant menace, but the now melting masses, that covered every ledge, threatened to slide from under our weight and drag us over the cliffs. We found that the steps we had cut in the ice slope of the couloir below, had nearly melted away, and the whole mass looked as if it would slip down over the cliff if we so much as touched it. But it was our only possible way down, and we had to hurry for each moment added to our dangers. We made a cairn at 11,500 feet. After we got below the snowline, we made good time, for Phillips was fast becoming expert in mountaineering.

Reaching the level of the big west shoulder, up which I had climbed in 1908 in a blizzard, I left Phillips in charge of my camera, and for half a mile followed the narrow ledges, till I stood on the summit of that noble view point. The sun was just setting, Phillips was a mere dot on a cliff to the north, the lake that Dr. Coleman named after me, and the "Valley of a Thousand Falls" lay 8,000 feet directly below.

These and the valley of the Fraser, with its little thread of silver, were being engulfed with darkening blues and indigos as twilight flooded the innumerable peaks and glaciers on every hand. But above me swept a long slope of snow clear to Mt. Robson's highest pinnacle. Though tipped at a fearfully steep angle and with bands of black across its white spoke of cliffs to climb, the contrast it presented to the almost perpendicular cliffs we had been climbing during the past four days, filled me, for the first time, with joy and confidence of ultimate success.

I hurried back to Phillips and told him the good news, and we determined to make the top of that west shoulder our "Highest Up" camp the next day.

But this little side trip had delayed us considerably. We had planned to enjoy a real supper and to sleep comfortably that night in Camp Robson at the foot of the mountain. In fact we had to cut steps in the ice of those steep couloirs and get down the last 500 feet of cliffs in the dark of night, before we reached our "Higher Up" camp in the cliffs.

There was nothing left for us to do but camp there again at 10,000 feet altitude, in the wind and cold, on that narrow ledge. I started a little fire and warmed up our stock of stew, while Phillips made our bed. There, partly covered under our blankets, we ate our supper in the dark and watched the gathering storm-clouds blot out the white-capped peaks at our feet.

The storm soon swooped down upon us burying our little world in white, while the tempest of wind threatened to tear the very cliffs to pieces. I do not suppose there is any place where the wind can blow so hard as on an exposed mountain top.

Phillips and I curled up so closely together that we managed to keep from freezing, though it was a most uncomfortable night.

By daylight it was storming as hard as ever. The rocks that had been warm in the sun of the day before, still retained enough heat to melt some of the snow that fell, so by morning the drip from the cliffs had wet our blankets through, and we were driven to seek Camp Robson, at the foot of the mountain several thousand feet below. Packing up our wet blankets and without any breakfast, for we could not start a fire and we were too cold to eat, we plunged through the storm and glissaded down a long slide of snow. A thousand feet below where we had slept, we got below the storm, and in a couple of hours had got down the cliffs of the north shoulder, and were once more comfortably feeding at our camp fire at the base of the mountain.

For eleven days it stormed on Mt. Robson, so that it was folly to attempt to climb it. We cooked the last of our flour, and our sugar and other necessities disappeared. Yet we had to be in good shape for the final climb, if the weather would only clear up. For eleven days we roamed that country from valley to storm-swept peaks, hunting for game that we might live.

At last the weather began to clear up, and Monday Aug. 9, we climbed again that rugged north shoulder. Crossing the difficult shale slope, we passed the camp spots of our former trips, and with our heavy fifty-pound packs, struggled up those fearful cliffs till we

reached an altitude of nearly 10,500 feet. We would soon have reached the top of the west shoulder, when a storm caught us. For a couple of hours we had watched the storm-clouds gather, then gradually obliterate the peaks; yet we pushed on, hoping they were only squally.

We were climbing in a narrow *col* when it began to snow. We did not mind it at first, but in a few minutes it had snowed three inches, and slides began to come down. Realizing at once our danger, we hastily cached our packs under a sheltering rock and

FIG. 3.—CAMP "HIGHER UP."

Here Kinney and Phillips slept two nights at an altitude of over 10,000 feet. They built a wall of rock to keep them from rolling off the narrow ledge down the mountain.

hurried down those cliffs. But we had a bad half-hour before we got out of danger and glissaded the draw down the long shale slope. We got down to camp Robson at the foot of the mountain in a discouraged frame of mind, for we were hundreds of miles from civilization, with scarcely any provisions, and the mountain was still unscaled.

For three days it stormed, and we lived on birds and marmot (a kind of mountain ground-hog). Then Thursday, Aug. 12th, dawned fine and clear. As we had lots of time to make our "Highest Up"

camp that day, we spent most of the morning repairing our boots and clothing and making ready for our final climb. After an early dinner, we climbed the several thousand feet of cliff to where we had cached our packs the Monday the storm caught us. Shouldering our packs, we climbed more cliffs, and finally worked our way to the top of the west shoulder, 10,500 feet above the sea. Here at an altitude equal to that of Mt. Stephen, we chopped away a couple of feet of snow and ice, and feathered our bed with dry slate stones. We shivered over the little fire that warmed our stew, and then amid earth's grandest scenes, we went to bed with the sun and shivered through a wretched night.

Friday, Aug. 13th; dawned cold and clear, but with the clouds gathering in the south. Using our blankets for a wind-brake we made a fire with a handful of sticks, and nearly froze as we ate out of the pot of boiling stew on the little fire. Then we placed stones on our blankets so they would not blow away, and facing the icy wind from the south, started up that west side of the upper part of the peak.

The snow was in the finest climbing condition, and the rock-work though steep offered good going. Rapidly working our way to the south, and crossing several ridges, we had reached, in an hour, the first of two long cliffs that formed horizontal ramparts all around the peak. We lost half an hour getting up this cliff, but finally found an easy way.

But the clouds that came up with a strong south wind, had gradually obscured the peak, till at the cliff, they were swirling by us on our level, and at the top of the cliffs it began to snow. For a moment I stood silent, and then turning to my companion said: "Curlie my heart is broken." For a storm on the peak meant avalanches on that fearful slope, and there would be no escaping them. So I thought that we would have to turn back. Our provisions were now so low that we would not have enough to make another two-day trip up the mountain. So it meant that this was our last chance.

But to my surprise it did not snow much, the clouds being mostly a dense mist. In a few minutes I said, "Let us make a rush for the little peak," meaning the north edge of the peak which was directly above us.

"All right," said Curlie, from whom I never heard a word of discouragement. And away we started, keeping to the hard snow slopes. Though these were extremely steep, the snow was in such

splendid condition that we could just stick our toes in and climb right up hand over hand.

By the time we had conquered the second of the long ramparts of cliffs, that form black threads across the white of the peak, we concluded that it was not going to snow very hard, as the clouds were mostly mist and sleet.

Swinging again toward the south, we headed directly for the highest point of the mountain, which we could see now and then through the clouds. Small traverse cliffs of rock were constantly

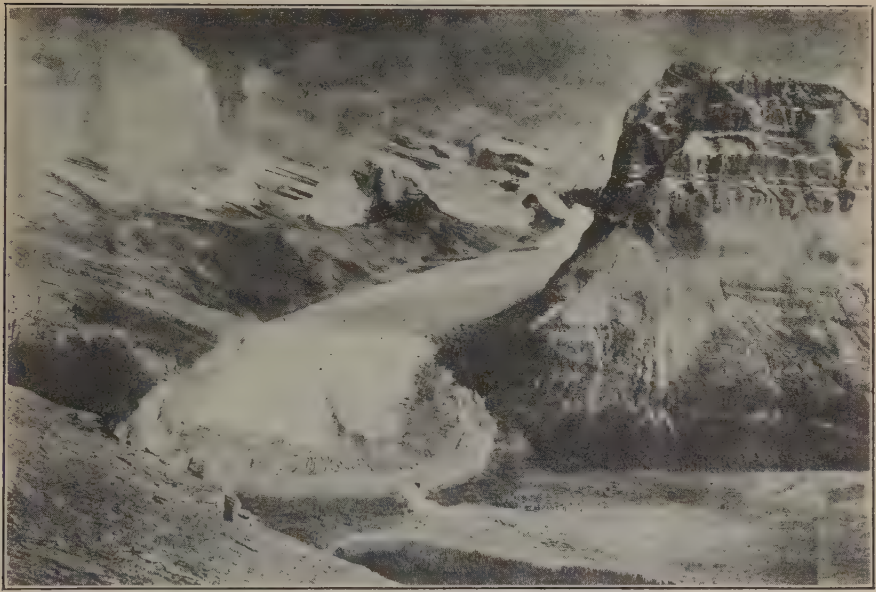

FIG. 4.—THE BIG GLACIER.

The Glacier is on the east side of Mt. Robson. The view was taken from a peak several miles away. This fine ice river is a mile wide and five miles long. It marks the boundary between the Provinces of Alberta and British Columbia.

encountered, but they were so broken up that we could easily get by them, by keeping to the snow of the little draws.

For hours we steadily climbed those dreadful slopes. So fearfully steep were they that we climbed for hundreds of feet, where, standing erect in my foot-holds, the surface of the slopes were not more than a foot and a half from my face; while the average angle must have been over 60°. There were no places where we could rest. Every few minutes we would make foot-holds in the snow

large enough to enable us to stand on our heels as well as our toes, or we would distribute our weight on toe and hand-holds, and rest by lying up against that wall of snow; for on all that upper climb we did nearly all our work on our toes and hands only.

The clouds were a blessing in a way, for they shut out the view of the fearful depths below us. A single slip any time during that day meant a slide to death. At times the storm was so thick that we could see but a few yards, and the sleet would cut our faces and nearly blind us. Our clothes and hair were one frozen mass of snow and ice.

When within 500 feet of the top, we encountered a number of cliffs, covered with overhanging masses of snow, that were almost impossible to negotiate, and the snow at that altitude was so dry that it would crumble to powder and offer poor footing. We got in several difficult places that were hard to overcome, but we finally fought our way up the last cliffs, only to find an almost insurmountable difficulty. The prevailing winds being from the west and south, the snow, driven by the fierce gales, had built out against the wind in fantastic masses of crystal, forming huge cornices all along the peak, that can easily be distinguished from the mouth of the Grand Forks some ten miles away. We finally floundered through those treacherous masses and stood at last on the very summit of Mt. Robson.

I was astonished to find myself looking into a gulf right before me. Telling Phillips to anchor himself well, for he was still below me, I struck the edge of the snow with the staff of my ice axe and it cut through to my very feet, and through that little gap at my feet, that I had made in the cornice, I was looking down a sheer wall of precipice that reached to the glacier at the foot of Berg Lake, thousands of feet below. I was on a needle peak that rose so abruptly that even cornices cannot build out very far out on it. Bearing my head I said: "In the name of Almighty God, by whose strength I have climbed here, I capture this peak Mt. Robson for my own country, and for the Alpine Club of Canada." Then just as Phillips and I congratulated each other, the sun came out for a minute or two, and through the rifts in the clouds, the valleys about us showed their fearful depths. The Fraser lay a thread of silver, over 11,000 feet below us. Before I could take any photos the clouds shut in again thicker than ever.

"We were nearly frozen, so we could not remain at the top till the

FIG. 5.—MT. ROBSON.

As the tourist on the Grand Trunk Pacific R.R. will see it from the car windows. Taken from the mouth of the Grand Forks, eight or ten miles away.

clouds should break. We could not build a cairn there, in which to cache the Canadian flag that Mrs. Dr. George Anderson of Calgary had donated, and our records, for if we left them in the snow they would have been lost; so we cached them on our return, in a splendid natural cairn, a few hundred feet below the peak."

On three different little cliffs near the peak, we met with great difficulties in getting down, but we finally managed. After caching our cairn and getting down near the 12,000 foot level, we found a new danger that nearly finished us. The storm had increased but the temperature had risen.

In fact a chinook was melting the lower snows. We found our trail nearly melted away. To make the matter worse, the slopes were so steep that the snow never could lie very deep, even in the couloirs; and we frequently had to make detours around places, where the ice or rock beneath the thin snow, would allow of no foot-holds whatever.

It was so cold and stormy at the peak, we did not get anything out of our packs to eat. While I fixed the cairn, Phillips ate some chocolate, and, later, I snatched a moment to eat some, paper and all. But during the twelve hours climbing and returning on that slope, there was no time to do anything but get to the peak and then to safety. So very dangerous did the snow get, that our return trip cost us seven hours of distressing work, while the climb to the peak was made from our "Highest Up" camp at 10,500 feet in five hours. We had to use the rope all the way down, and only one of us could move at a time, while the other got as good an anchorage as possible. But finally we reached the lower of the two bands of cliffs where we unroped, and then rapidly got down to camp "Higher Up," where we soon devoured everything edible in sight.

The storm was raging fiercely above us, night was gathering, and we had thousands of feet of cliff still to climb down, before reaching Camp Robson that night. Yet we lingered on that West shoulder, eating and resting, and oh so glad that the peak had at last really been won.

It was a long three hour struggle with our packs down those cliffs. We had half a mile or more of ledges to follow to the north, there were several deep gorges with ice steps to cross, then a long glissade and more cliffs. So it was long after dark before we reached Camp Robson. We finished the return trip from peak to base in twenty hours. We were so tired we could hardly eat or

rest and our feet were very sore from making toe-holds in the hard snow.

But we had stood on the peak of Mt. Robson, and the struggle had been a desperate one. Three times we had made two-day climbs up Mt. Robson, spending ninety-six hours in all, above 10,000 feet altitude, so far north. During the twenty days we were at Camp Robson we captured five virgin peaks, including Mt. Robson, and made twenty-three big climbs.

I had now only one horse left, for the other one that I had brought in had caught swamp fever on the trail and now his bones bleach under the cliffs of the north shoulder of Mt. Robson. We caught our horse the next day, and with many a backward look at the conquered peak glistening in a clear sky, we left that scene of so many battles and still wondered at our victory. For days we had to live on what gophers and birds we could get, for we were out of other provisions.

On the Athabasca we met the members of the British Alpine party going in to the mountain, and received their hearty congratulations. Unfortunately weather conditions prevented these courageous men from also capturing the peak.

Others will doubtless some day stand on Mt. Robson's lonely peak; but they who conquer its rugged crags, will ever after cherish in their hearts a due respect and veneration for its mighty solitudes.

AN UNKNOWN FIELD IN AMERICAN ARCHÆOLOGY

BY

HARLAN I. SMITH

The unknown field in North American archæology is far greater in area than the known field. Nothing is understood of the life of the prehistoric people, the direction from which they came, or when they arrived, in a portion of the United States and Canada larger than all the rest of those countries. This area stretches from the Gulf of Mexico to the Arctic Ocean and occupies most of the country between the Mississippi valley and the Coast Range. It includes the Mackenzie basin, the Barren Lands and the great plains. In

the United States, eastern Washington, Oregon, and California, all of Idaho, Montana, Wyoming and Nevada, northern Utah and Colorado, all of Texas but the eastern edge, most of Oklahoma, Kansas, and Nebraska and the western part of the Dakotas belong to this region which we may popularly term darkest archæological America.

Remains indicating the presence of man in America at the close of the glacial period or other very early times have been reported from various places in the country, but none of them is as yet fully established to the satisfaction of all archæologists. Near Trenton, N. J., many rudely chipped stone objects which have been termed "palæolithic implements" and bones of animals no longer native to the temperate regions (as well as of man), which were thought to bear marks of human handiwork, have been found in what was supposed to be undisturbed glacial deposits.

Among several reported finds in Ohio I may mention similar "palæolithic implements" reported by Mills and Metz. Such stones were reported by Cresson from Indiana and by Miss Babbitt from Minnesota. The human bones found at Lansing, Kansas, and near Omaha, Nebraska, known respectively as the "Lansing Man" and the "Nebraska Man" are not yet accepted by all, but are considered as probably of comparatively recent Indians.

A human figurine, said to have been taken from an artesian well in Idaho, for a time excited attention. The "Calaveras Skull," a human skull found in a cave in Calaveras Co., Cal., for years was considered as conclusive evidence of the great antiquity of man. Bones, some of which are thought to have been carved, associated with remains of extinct animals in another cave in California have been examined by St. Clair and Putnam.

Archæologists as a class may be said to await proof of the great antiquity of man in America. Consequently as all these reports, with the exception of that of the Idaho image, came from the smaller or archæologically known part of the country and they all together have not established the question, there is all the more reason to desire information from the larger or unknown part of North America.

When this vast region was first visited by white people it was found to be inhabited by certain Indian tribes whose languages differed as much from one another as French from Spanish, and between some of the languages there was the same affiliation as we find between these tongues. Students have come to group them

into linguistic stocks, just as those two European languages are grouped under the Aryan stock. The languages of one stock differ from those of another, just as the Spanish does from Turkish. It so happens that this area includes part of the territory inhabited by the tribes of the Algonquian and Caddoan linguistic stocks, and all of the country of the Kiowan and Kitunahan linguistic stocks. But the Athapascan, Siouan and Shoshonian peoples occupied the greater part of the area and it is also true that the greater part of their country lay within the borders of this unknown territory. To know the early history of these great groups of entirely different peoples we must know the archæology of that part of the country.

As there were differences in language so there were differences in life or material culture. This was partly due to the effect of environment. There are among these cultures those of the eastern forest, the Arctic seacoast, the Barren Lands, the plateaus, the plains and the arid southwest. Part of these areas are included in the unknown region, while all here mentioned extend into it. A knowledge of how the cultures within the unknown area developed can only be obtained by archæological explorations, and to know the limits of the other cultures above mentioned it will be necessary to prospect out into the unknown region.

The plains which may be considered the nucleus of the unknown territory may hold the key to the whole situation. In historic times they have been inhabited by nomadic peoples. Tribes of the eastern forest culture, such as the Blackfeet, have migrated into them and become nomadic.

In the early days the peoples of the plains had only the dog as a domesticated beast of burden and draft. True, the horse developed from a little five toed creature to a splendid animal somewhat resembling our modern horse in this area, but, according to present scientific belief, he became extinct before man appeared in this country. When the white people first saw the Indians of the plains they had great numbers of horses and may be said to have had a horse culture. But these horses they obtained overland in one way or another, after the Spaniards had brought this animal to America. The horse must have greatly effected their culture, allowing them to travel farther, hunt the buffalo with greater success, migrate more easily and obtain and transport more property. The story of how these people lived before they had horses and the history of the change from a culture where they had only the dog, to one almost

dependent on the horse cannot be fully known without archæological research in the great plains.

The plains formerly supported immense herds of buffalo. It is said that there were more buffalo killed on the plains in ten years than there are people in England. Now they are found only in public or private parks, and a society has been formed to prevent their extinction. The culture of the plains people depended perhaps even more upon the buffalo than it did upon the dog or horse. Zoologists have determined the former range of the buffalo and it will be of considerable interest and importance to ascertain whether or not the culture of the buffalo area was of one sort throughout, due to this animal and if the culture immediately outside of the buffalo area was of an entirely different sort.

Corn was raised throughout the eastern part of the United States and Canada as far north as the climate would permit and for some distance westward out on the plains. Curiously enough pottery is found to have been made wherever corn was raised in the United States. This territory also includes the irrigated fields of the desert region of the southwest. On the other hand no pottery is found in British Columbia, Washington, Oregon and the vast bordering region. The unknown archæological area lying between this Pacific coast country and the regions where corn and pottery were abundant, of course, holds the key to the limits of the territory where the potter's art was known in this part of the world.

The material culture of the country to the east of this vast neglected area is fairly well known. Immediately adjacent in the great Mississippi valley was a sedentary agricultural people who also depended upon certain wild plant products and largely upon game and fish.

The archæology of the eastern region in general is characterized by many well known objects.

The prehistoric culture of the Cliff Dwelling and Pueblo area of the southwest is also well known, although our knowledge of it has been gained chiefly during the past thirty years. Even though a desert country, its culture was agricultural and its people even more sedentary than some of those in the Mississippi valley. It may be said to be characterized by flat topped stone and adobe buildings, the best pottery found north of Mexico and irrigation projects.

To the west, the culture of the Santa Barbara region of California is well represented in our museums.

Northwest of the unknown region are the plateaus of British Columbia and Washington, the native culture of which we know. Here the people depended upon many resources, lived in small villages composed of individual houses and depended chiefly upon hunting and fishing for subsistence.

The part of the vast unknown archæological area which interests us most, is that which lies in our own country, partly from patriotic reasons and partly because the colder northern region would seem to promise meager results and even more extensive stretches between the sites of antiquities than are found in the plains.

Wyoming, near the center of that part of the unknown region lying in the United States, includes the head waters of the Snake, which passes through the northwest plateau country; the Colorado, which cuts through the Pueblo region, and the Platte, whose waters descend to the Mississippi valley. If the three cultures found lower down in these valleys occupied the entire drainage basin of each, Wyoming would certainly hold the key to the problem, and it was partly for this reason that I selected the south and east part of that State for the field of my first trips of reconnoissance into the great unknown archæological area. These trips were made under the auspices of the American Museum of Natural History in 1907 and 1908.

While Wyoming is not the largest of the States in the unknown area and is a mere speck compared with the whole, if superimposed on a part of the Middle Atlantic states where thousands of dollars and years of effort have been spent in archæological research, we find that it is larger than Massachusetts, Rhode Island, Connecticut, and New Jersey, parts of New Hampshire, Vermont, New York, Pennsylvania, Maryland and Delaware, with a goodly portion of the Atlantic ocean thrown in. So it would seem that if New Jersey or Connecticut both deserved extensive exploration, this larger State had been neglected long enough.

My route in 1907 lay along the line of the Chicago and Northwestern R.R. from east to west across the middle of the State. This was in the Platte valley and with the railroad as a base, side trips were made on foot, with saddle horses and with mountain wagons. From the western terminus of the railroad the route lay across the continental divide, through the Red Desert, southwestward to the Union Pacific Railroad. From here horses took us to various points up and down the Green River valley and the railroad was again

used as a base in recrossing the State parallel to, but further south than our former route. In 1908 I went by wagon from Raw Hide Buttes to the Black Hills. Then westward to the Big Horn Mountains and southwest to Casper; thus circling the northeastern part of the State.

The southern and eastern parts of Wyoming are an arid, rolling country, cut by many cañons, most of which are dry and are practically treeless, except for willows and cottonwoods in some of the bottomlands, or pines and cedars on a few of the hills. The cowboy well describes it by saying:

"There are more cows and less butter, more creeks and less water, and you can see farther and see less than in any other part of the country."

The results of our expeditions include the discovery of a new form of steatite pot, quite as different from the type found on the Atlantic seaboard as from those of California; several boxes of specimens; over a gross of photographs showing the country, and its antiquities; and a knowledge of the distribution of archæological forms and sites.

The chief antiquities of the region consist of hundreds of circles of stones marking ancient lodge sites, principally in the east; prehistoric quarries, some of them covering acres in the east and petroglyphs especially in the north and west. The circles of stone instead of being in the river bottoms, as are the village sites of the Mississippi valley, are usually on high ridges but near a stream or spring. Sometimes a single circle is seen, again there are whole villages indicated by them. There is nothing to prove the age of these circles except that most, if not all, of the stones are sunk some distance into the soil. The modern Blackfeet, living in Montana, use stones to hold down the edges of their tipis, while the Shoshone, in western Wyoming, as a rule, do not. This may account for the scarcity of stone tipis circles in western Wyoming. An occasional saucer-shaped depression in the earth, probably also a mark of tipis sites of a people with practices like the modern Shoshone, was also seen.

The quarries, each of which covered several acres, were found in many places in the Platte valley. Those locally known as the "Spanish Diggings" because once attributed to early Spanish gold miners, have been known for some time, but others are new to science. The quarries are marked by pits dug down through the earth to get the quartzite and jasper desired as material for chipping

into points for arrows, scrapers, knives and possibly other forms of implements. Arrow points are found scattered over the whole country and sheep herders amuse themselves by collecting them, while scrapers are very numerous among tipis circles. Lying about the pits are, occasionally, river pebbles which have been battered from use as hammers in the quarrying operations. Some of them have grooves pecked around the middle where a handle could have been bound on. One of these was photographed before it was picked up from the ground where it lay among the quarry refuse, broken out by it or by similar pebbles. Such pebbles are not found scattered about over this quarry country and must have been brought some distance from the river valleys. At each quarry are actually train loads of rock which have been broken out by these stone hammers and from most of it has been trimmed the poorer material which would not do for the making of implements. In this trimming process there have been left carloads of almond-shaped pieces from four to twelve inches in length, chipped in such a way that they have a cutting edge all around and if any of the poorer rock remains it is in the middle of the flat sides. These are the natural results of the best way which primitive people have of chipping the poor material from a block of rock. They resemble "paleolithic implements," but their surfaces do not bear as much patina, that is, they are not so much decayed or weathered. They also resemble unfinished implements, such as are found among the quarry rejects of the eastern United States, but they are probably either pieces of rock suitable for the making of implements which have assumed this form in the process of freeing them from the unsuitable rock, or they may be cores from which first the unsuitable rock has been chipped and then many chips have been taken off for transportation to the home of the quarryman.

That the rock was not extensively worked into chipped implements at the quarries is indicated by the scarcity of small flakes and finished implements in their vicinity. The scrapers in the tipis circles are about the only finished implements commonly found and this is probably because the women were busy tanning the skins of antelope and buffalo, animals formerly numerous here, while the men were occupied at the quarries. The vicinity is so desolate and water so scarce that when not engaged in quarrying or hunting these animals the people probably lived elsewhere. There is no great accumulation of village refuse to indicate long habitation near the quarries.

The antiquity of these quarries goes back to times before historic record in this region, which began about a century ago. The absence of objects made by white people, such as implements of iron or glass beads, shows that it was before the Indians had much contact with our people, but nothing has thus far been found to indicate their remote antiquity.

A fragment of an arrow shaft smoother was found near Lusk, in the eastern part of the State. It will be remembered that these are common in the northwest plateau region, the Pueblo country, and have been found in Nebraska, so that we might expect to find them among antiquities in this middle region, especially since some of the modern Indians here have used them.

Large flat grindstones or lower handmills with small grinders or upper handmills, like the metates of the Pueblo country, are found through southern Wyoming, but are perhaps more numerous in the western part which is in the same drainage basin as the Pueblos. They certainly remind one of the Pueblo culture, and this type of them is unknown in America north of southern Wyoming.

The historic plains tribes customarily boiled their food by dropping hot stones into a buffalo paunch containing it. But the fact that they also used stone pots accounts satisfactorily for the numbers which we saw. As before mentioned, they are of a shape new to science, unlike the trough-shaped dishes of the east and the globular ollas of California, some being of the form of an egg with the tip of the larger end removed, others of a steep truncated pyramid with rounded corners and bulging sides, while others are somewhat of the latter form, but longer than they are wide.

Pottery was not extensively made here, resort to paunch boiling or steatite pots no doubt taking its place. We found it only near Raw Hide Buttes on the trip and learned of its occurrence at only eight places. All these were in the southern part of the State. Some of the pottery which we saw somewhat resembles that of the Cliff Dwelling country immediately to the south. The northern limit of pottery in this longitude is probably marked by these eight finds. It will be remembered that pottery is not found farther north of this in any of the country to the west, except in a small region near the Yukon, which it may have reached from Siberia, but in the Mississippi valley it is found as far north as maize was planted and as far northwest as Mandan, Dakota.

One of the pieces of pottery is of especial interest. It is in the

possession of a druggist living at Douglas. It was found in a cave some miles south of that city and strongly reminds us of the coiled ware of the Pueblo country. Close examination, however, especially where it was broken and could be seen in cross section, convinced me that it had been molded in a basket. It is one of the two best examples of pottery made in a basket that I have seen. The top of the pot being smaller than the body, it could not have been taken out of the basket, which must have been burned in firing the jar.

A number of caves were seen both in the eastern and western parts of the State. Some in each region had been barricaded with poles, which had been preserved by the dry climate and appeared very ancient. They were lashed together with withes. In one of the caves in eastern Wyoming was a great accumulation of débris, and in front of it were tipis circles and more evidence of village débris than I saw elsewhere in the State. The top of the refuse in the cave was strewn with the bones of sheep and cattle, probably dragged there recently by wild animals. The presence of pictographs near the cave and of the unusual traces of habitation in front of it, led me to believe that the lower layers of cave refuse might contain human remains or manufactures, thus holding evidence for a knowldge of these Wyoming cave dwellers. For this reason I have recommended the caves as one of the more promising fields for future exploration.

A boulder mosiac, representing a human figure, many feet in length, as indicated by boulders placed on the ground, has been described by visitors to the "Spanish Diggings" country. Such figures are well known in Dakota.

Lines, some many miles in extent, are formed usually by single boulders or little piles of stones, although in one case the piles were rather large. These were found, in a number of places mostly in the eastern part of the State and their use has given rise to much speculation. Some consider them to mark boundary lines, others to indicate trails across the prairies, or guiding decoys for the capture of buffalo.

A few graves, covered with stones, have been found in Converse Co. and similar stone piles have been excavated but found to cover only bits of charcoal. Small piles of stone sometimes found in the center of tipis circles are scorched upon the lower side and are supposed to mark fire places.

A stone "fort," so called for want of a better name, was seen and

photographed on top of one of the Raw Hide Buttes. It consists of two walls of rock crossing a narrow defile on top of the butte, but whether this was made by prehistoric Indians or early white visitors to the region is unknown. A single wall or pile of rocks crosses the same defile at two points further along on the butte.

Petroglyphs are found in both the eastern and western parts of the State and pictographs, both red and black, occur in the Wind River country. We saw only one set of petroglyphs in the southeastern part of the State. These were near the cave previously mentioned. They were in the area formerly inhabited by Caddoan tribes. In the vicinity there lived the Arapahoes of the Algonkin stock who formerly inhabited the wooded area to the northeast. There were three of these representing human forms scratched in the red sandstone. They resemble in character the birch bark pictographs of eastern Algonkin forest tribes. In the western part of the State petroglyphs are of two kinds; one, pecked or bruised so as to make a fresh mark upon the surface of weathered basaltic rock, the other scratched and pecked intaglio in the sandstone. Some of the latter seem to be recently made, while some of the former appear very old. The first kind may be of Shoshonean origin; the second resemble in character the pictures painted on skins by recent plains tribes. The horse is frequently represented in the characteristic conventional style of the plains Indians and one picture of a buffalo is rather striking. The Arapaho, who adopted the prairie culture since their migration to the plains, were removed to this region by the United States government and now live side by side with Shoshones.

The eastern part of Wyoming seems to have been more thickly settled in primitive times than the middle or even the Green river valley of the western part. Signs of man, especially petroglyphs, are numerous in the Wind river country. The continental divide in the region of South Pass does not seem to be what would have been much of a barrier for primitive peoples. I have a suspicion that the remains in the eastern part of the State belong to the western parts of an ancient plains culture. Those in the west probably belong to a type of culture which came, transmitted over the continental divide, from the Pacific drainage.

The pottery and metates, found in the middle part of the State, seem to attest that Cliff Dwelling influence extended to this vicinity.

An archæological reconnaissance across the northwestern part of

the State would do much to settle these questions, while an exploration of the caves in the east and the photographing of all the petroglyphs of which we heard in the west so that a comparative study could be made of them, would give us a more detailed understanding than can be had from a mere reconnaissance. One of the problems of most interest to ethnologists is whether the plains have been inhabited for any considerable number of years, say before the introduction of the modern horse. An exploration of the caves may throw light on this problem, but in all this work of determining the location, character and age of cultures there must be co-operation between archæologists, geologists, linguists, ethnologists and students of mythology and tradition.

KORDOFAN

Kordofan is the large Province of the Anglo-Egyptian Sudan between the Nile and Darfur. Knowledge of this large region was quite imperfect until the British ended the régime of the Mahdi in 1899. Since that time the British have traversed the country in all directions and have made a map of a large part of the province on a scale of 1:250,000 which gives a very good idea of it, though the map is not based on triangulation.

Captain Watkiss Lloyd, recently governor of Kordofan, has an article on this large region in the *Geographical Journal* (March, 1910, pp. 249-267, map and illustrations), in which he contributes many new facts to our knowledge of Kordofan. The following data are taken from his paper:

The province includes about 130,000 square miles with an estimated population of about 500,000. It extends about 400 miles N. and S. and 350 miles E. and W. It is naturally divided into two parts, North and South Kordofan, the dividing line extending obliquely from lat. 12° N., on the frontier of Darfur, to lat. 13° N. on the White Nile.

North Kordofan consists of plains, generally sandy, formed by the disintegration of granite and sandstone hills and broken in the north by clusters of granite hills. North of lat. 14° 30′ N., the plains are often stony and broken by many wadis, the streams losing themselves in the sand or forming small lakes that dry up after the

rains cease. The natives often work the salt that is left behind. The plains are either bare or covered by low bush that is thicker in the wadis. The real bush begins about lat 14° 30′ N., where the country becomes more undulating. The rain usually sinks where it falls, there being no visible watershed. This district extends south to the dividing line between northern and southern Kordofan, and in it are most of the gum forests which are the chief wealth of the province.

Along the Nile is a belt of low ground, chiefly black soil, in places 12 miles wide, very fertile, broken by many watercourses and politically attached to the White Nile province. The country rises rapidly westward, becomes much more sandy, and, about 40 miles west of the Nile the rainless and almost treeless district of El Akaba begins, extending westward for 50 miles. This district is uninhabited except during the rains, when the population drive their flocks into it. The hills become higher and steeper to the west, till a level plain is entered near El Obeid, the chief town of Kordofan. To the north of this town is the district of El Kheiran, where the sandhills enclose a number of small basins with fertile soil, and water at depths of 4 to 10 feet, once highly cultivated, devastated by the Dervishes, but now rapidly recovering.

Around El Obeid, the soil is much less sandy, the wells are quite numerous, particularly in the town, and there are many villages. Thirty miles west of El Obeid begin the sandy, bush-covered steppes of Dar Hamar, extending to the Darfur frontier, about 170 miles.

Water is the chief topic in northern Kordofan. It is a mistake to regard the country west of Khartum as a waterless district, though there is not enough to support a large sedentary population. In the most of Dar Hamar, however, the people are dependent for water chiefly upon watermelons and the supply they store in the trunks of baobab trees. Melons are grown in enormous quantities and kept in heaps, protected from the sun, until needed. A hole is cut in the hollow trunk of the baobab tree and the cavity is filled with rainwater to be drawn upon as required.

Southern Kordofan is the home of the Baggara or cattle-owning Arabs and Nubas. This is a very different country, consisting of a plain of black soil, from the middle of which the rugged hills of Dar Nuba rise to a height of 3,000 feet. The rain does not sink where it falls, as in the north, but the country is drained by several considerable watercourses, filled during the rains, but dry a few weeks later. The country between the White Nile and Dar Nuba

is about 150 miles square, many of the hills being masses of huge granite rocks containing many caves and hiding places utilized by the Nubas in time of war. West of Dar Nuba, the plain extends to beyond the Darfur frontier and is covered with bush except where cleared for cultivation. The bush gradually changes to forest towards the south.

The drainage system of southern Kordofan is exceedingly simple. The Khor Abu Habl rises in the hills west of Dilling and flows N. E. to Sungikai, where it turns east, finally losing itself in the sandhills near Gedid. It is joined by many affluents from the south and there are good wells along its course. The climatic variations are considerable in Kordofan. The rains begin earlier, about March 15, in the south and end later in the north. The climate at El Obeid is pleasant from November to March, when the heat becomes oppressive, until the wind, turning to the south, about the end of April, brings the first rains. The wet season lasts till about the middle of October, when the wind goes around to the north. At El Obeid the rainfall seldom exceeds 25 inches. In the south, the rains are much heavier and last longer. Malaria is the chief cause of sickness, but the war on the mosquito is improving matters at the Government posts.

Arabs and Nubas form the population, the latter being confined to the hills of southern Kordofan. The Arabs are divided into camel-owners, sedentary tribes and Baggara or cattle-owners. The camel-owners live in the northern and drier part of Kordofan and also own many sheep, goats and a few horses. Most of them live in tents, do not till the soil and subsist on camels' milk and the grain they buy from settled tribes. The nomad Arabs always regard a tiller of the soil as inferior to them.

The sedentary tribes live between lat. 14° and 12° N. The Gawama tribe owns all the best gum forests and is the richest of these tribes. The sedentary tribes all live in villages which seldom contain more than sixty families. The only large towns are El Obeid, capital of the province (pop., 12,000), and Nahud, with 10,000 inhabitants, between El Obeid and Dar Fur. The chief trade of the capital is in grain, cattle, cotton cloth and gums. The trade of Nahud is mostly with Darfur, the town sending cottons and trade goods west in exchange for cattle and ivory.

Practically all the Arabs of southern Kordofan belong to Baggara or cattle owning tribes. They have a bad name on account of their cruelties under the Khalifa, but they are the most enterprising

people in the province, and many of the poorer men go to Khartum to work in the public service till they have money enough to buy some cattle and settle down in their own country.

The Nubas, all living in the southern hill country, have often been raided by the Baggara Arabs for slaves and cattle and were terribly harassed under the Dervish rule. Under the present régime, they are gradually settling down, though they raid one another, from time to time. They cultivate a great deal of land and have many cattle, sheep and goats.

The resources of Kordofan are considerable, but require time and population to develop them. All the main roads have now been cleared of bush, and a railroad is to be built from the Nile near Kosti to El Obeid, but at present all transport is by camels in the north and pack-bulls and donkeys in the south. The chief source of revenue is gum arabic, but, as yet, only a small part of the vast gum forests are being worked. The herds of camels and cattle are very important, but mineral resources are rather limited. Iron is plentiful and salt is found in considerable quantities. On the whole, Kordofan is fairly rich as countries go in Central Africa. The revenue is now about $300,000 and the expenditures $175,000, so that the province is paying its way and contributing its share to the central administration. It will be a generation or more before the enormous losses from battle and famine under the Mahdist despotism can be replaced, though there is now no tribe that cannot be described as fairly well off.

GEOGRAPHICAL RECORD

NORTH AMERICA

California's Mineral Output in 1909. Lewis E. Aubury, State Mineralogist of California, informs the *Bulletin* that, subject to trifling alterations, the statistical mineral returns for the State, in 1909, exclusive of gold, silver and platinum, figures for which are being collected by the U. S. Census Bureau, will reach over $61,324,000. The precious metals will bring the aggregate up to $80,000,000 and probably more. The value of the total mineral production will exceed that of 1908 by about $14,000,000. The value of the total output in 1907 was $55,697,949; 1908, $66,363,198; 1909, about $80,000,0000.

A large part of the advance of 1909 over 1908 was due to the increase in production and average price of petroleum. The output of petroleum in 1909 was 58,191,723 barrels valued at $32,398,187. California, in 1908, led all the

States in petroleum production. Here are the quantities and values of the leading mineral products of California excepting gold, silver and platinum in 1909:

	QUANTITY.	VALUE.		QUANTITY.	VALUE.
Asphalt	136,664 tons	$1,707,159	Macadam	3,567,120 tons	$1,636,125
Borax	33,257,000 lbs	1,163,960	Marble	79,600 cu. ft.	238,400
Cement	3,770,504 bbls.	4,954,210	Mineral Water	2,419,834 gallons	462,488
Brick	333,846 M.	3,059,929	Natural Gas	1,147,502 M. cu. ft.	616,447
Clay (Pottery)	299,424 tons	460,697	Pyrites	457,867 tons	1,389,802
Coal	49,389 tons	216,913	Petroleum	58,191,723 bbls.	32,398,187
Copper	64,841,654 lbs.	8,283,202	Quicksilver	16,174 flasks	771,657
Granite	358,008 cu. ft.	376,834	Rubble	1,948,658 tons	1,063,809
Lime	520,752 bbls.	577,824	Salt	124,110 tons	339,671
Limestone	337,676 tons	419,921			

SOUTH AMERICA

The Trans-Continental Railroad in South America. The first railroad crossing the continent of South America was completed on April 2nd last and, three days later, was opened to general traffic. It connects Buenos Aires and Valparaiso, the track passing through the Cumbre Pass of the Andes, a defile extending between Mts. Aconcagua and Juncal, at an elevation of 10,600 feet above the sea. On the Argentine side, the most serious engineering work was the approach to Cumbre Pass, the grade up the mountain sides being so steep that the Abt system of cogs and racks was introduced for the safe movement of trains which also pass through a number of very costly tunnels on the way to the summit grade. A wagon road was completed through the Cumbre Pass in 1902, but the culminating difficulties of joining the rail routes that slowly approached one another on the Argentine and Chilean sides were not surmounted until this year. The final stages of the work, however, were carried forward with unexpected rapidity. It was said by the engineers, last year, that the road would be opened, from sea to sea in June, 1910, but the opening really occurred two months earlier.

The difficulties in the mountain section were even greater on the Chilean side, and were especially centered in the digging of a tunnel, 16,613 feet long which has, for several years, delayed the completion of the road. To reach the summit of the railroad, passengers and freight from Valparaiso are now lifted to a height of 10,600 feet above the sea, though the distance from the port to the summit is only a little over 100 miles.

Whether or not the complete efficiency of the road as a freight carrier will be impaired by the fact that the cog and rack system was necessarily introduced on short parts of the line, the value of the road, both to Argentina and Chile will be very great. This rail line, 887 miles long, between the largest Atlantic and the largest Pacific port of South America, will practically put an end to the passenger traffic between these ports through the Strait of Magellan, 3,224 miles, or by way of the still longer route of Cape Horn. Most of the commercial exchanges between Argentina and Chile will probably be made by the rail route and it will be a great advantage to the latter republic that the wheat fields of Argentina are brought much nearer to her.

A New Port in Argentina. The problem of adequate harborage in Argentina is paramount in the development of its commerce. Buenos Aires has been

extensively improved, the channel to Rosario has been dredged almost continuously for the past decade and a half, Bahia Blanca has been made into a fair port with good hope of becoming a first-class port, and still commercial outlets are required. A new venture, and a most promising one, is now before us. On the north side of Samborombon Bay, near Punta de las Piedras, on the S. side of the Rio de la Plata, "Puerto Argentino" is to be constructed. It is to be completed in five years and will be a deep-sea harbor allowing boats drawing 30 feet to enter at ordinary low tide. (Con. and Trade *Rep.*, July 11, 1910, No. 10.) It is to be built by the Port Argentine Great Railways Company, capitalized at nearly $60,000,000. The total length of the entrance channel will be nearly 50,000 feet and not less than $15,572,000 must be spent upon it; the docks will be 1,640 feet apart, 3,215 feet long and 1,050 feet wide, with a storage capacity of 100,000 tons which represents a movement of 800,000 tons a year. Goods will be transferred directly from ship to railway car. The motive power will be electricity. A model city will be built around the port with hotels, bathing beach, etc. In addition a dry dock will be built of sufficient size to accommodate the two new Dreadnoughts now being built for the Argentine navy in the United States. Dredges will at once begin work on the project and it is safe to say that in a few years the port will be in running order, for it is one of the most crying needs of commercial Argentina to-day. ISAIAH BOWMAN.

AFRICA

THE FRENCH IN WADAI. The French forces that have, for some time, been extending their occupancy and surveys in the central Sudan, have been considerably embarrassed by the opposition of the Sultanate of Wadai, a large territory, on the border of the Sahara, to the east of Lake Chad. Some of the French parties, not far from the Wadai border, were attacked by the natives. The French Government finally decided to occupy the Sultanate. In June last year, the French succeeded, with little difficulty, in taking possession of Abesher, the capital of Wadai, and no serious reverse was suffered till January last when Captain Fiegenschuh, who had commanded the operations in Wadai and established a garrison at Abesher, was attacked by an overwhelming force at the Tauil wells, in the territory of the Messalit tribe, and he, with two officers and 100 Senegalese soldiers, were killed to a man.

In other parts of Wadai, according to *L'Afrique française,* the French have met with little opposition. Lieut. Delacommune reports that, seven weeks after the occupancy of Abesher, he started from the capital with a small force and made a journey throughout the Sultanate, finding the conditions everywhere peaceful; and although the people were afraid of him, for this was their first meeting with a white man, they evinced a desire to be on friendly terms with the new régime. He says he passed through a very fertile country where large villages were thickly sprinkled and great fields of grain and fine herds of cattle were everywhere seen. The French have taken large quantities of firearms from the natives.

Apparently, most of the people of Wadai living under the rule of their Sultan Dudmurra, are better than the reputation the French had given them; but such a catastrophe as that of January last is not a surprising incident in the

course of operations to bring a large and strong people under subjection to foreign rule.

LIEUT. BOYD ALEXANDER KILLED. Lieutenant Boyd Alexander, known for his important scientific explorations in Africa, was killed by natives in the Soudan, on April 2.

WIRELESS TELEGRAPHY AT ZANZIBAR. Zanzibar has long felt the inconvenience of having no means of quick communications with the island of Pemba, about 70 miles to the north of the port of the larger island. This is due to the fact that Pemba is the largest source of the world's supply of cloves and the business of cultivating and marketing the spice is carried on entirely from Zanzibar. Some years ago, an attempt was made to establish a carrier pigeon service between the two islands but the hoped-for results were not realized. In December, 1907, the Lodge-Muirhead system of wireless telegraphy was installed, the stations being erected near the port of Zanzibar and Chake-Chake, the chief town of Pemba. The experiment has been very successful and the interests of the clove trade are being well served by the wireless system. The men engaged in the raising and marketing of cloves say they are glad to support the service for the advantages it gives them. (*Globus,* Vol. 97, p. 179, 1910.)

AUSTRALASIA AND OCEANIA

PIGMIES IN NEW GUINEA. The London *Times* (Weekly Edition, June 10, 1910), reports that the committee appointed by the British Ornithologists' Union to explore the snow mountains in Dutch New Guinea has reached its field of inquiries and has sent the information that, at an elevation of 2,000 feet, it discovered a tribe of pigmies, in the far interior of the island, whose average height is about 4 ft. 3 in. More definite details have not been received but there can be little doubt that they belong to the Negrito family. Anthropologists had widely accepted the view that the Negritos were not to be found in the Papuan sub-region, but their occurrence there now seems to be proven and the present discovery is likely to account for the presence of various anomalous races in the remoter parts of the Lesser Sunda Islands. Hitherto, these people have been known to inhabit only three widely separated regions—the Andaman Islands in the Bay of Bengal, the northern portion of the Malay Peninsula, where they are known as Semangs, and certain areas in the Philippine Islands, especially in the northern island of Luzon. Further details of this important discovery will be awaited with interest.

EDUCATIONAL GEOGRAPHY

GEOGRAPHY IN THE HIGHER SCHOOLS. According to Dr. Hermann Wagner's latest collection of data (*Geographischen Jahrbuch,* Vol. 32, 1909, pp. 439-446), there are 233 teachers of Geography in the higher schools of Europe and the other continents distributed among 131 institutions. As a university study, Geography is not yet a century old. Karl Ritter was the first professor of Geography, a chair being established in the University of Berlin in 1825 with this famous scholar as its occupant. In his "Methodik der Erdkunde" for 1842, J. E. Lüdde reported that in the summer semester of 1841, lectures on Geography had been given in the universities by Ritter in Berlin, Mendelssohn in Bonn, Fröbel in Zürich, Wappäus in Göttingen, Kutzen in Breslau, and Haug in

Tübingen. In 1871, about the same time that the new German Empire came into existence, chairs of Geography were established in nearly all the German Universities. In 1909, there were 54 teachers of Geography in 31 of the higher schools of Germany. All the German Universities, excepting those of Jena and Rostock, then maintained professorships of Geography. The study was fully represented also in the technical high schools of Aachen, Danzig, Darmstadt, Dresden, Munich, Stuttgart, the four commercial high schools of Berlin, Cologne, Frankfort on Main and Mannheim, the academy in Posen and the new Colonial Institute in Hamburg.

Next to Germany, the largest number of teachers of advanced Geography are found in Austria-Hungary, Switzerland, France, Italy, Belgium, Great Britain and Russia. The only European states without them are Greece and Turkey. In Great Britain, geographical progress has been marked, in recent years, and in 1909 there were chairs of Geography in Edinburgh, Glasgow, Sheffield and Aberystwyth, Wales. [Oxford now has a professorship of Geography.] "In the United States, the teaching of Physical Geography is in the hands of the Geologists and Geography, as such, has been assigned, only to a very small extent, to the care of specialists."

POLAR

Coal Production in Spitzbergen. The British Vice-Consul at Bergen, Norway, reports (*Bd. of Trade Jour.*, No. 707 June 10, 1910), that the Trondhjem-American Coal Co., otherwise known as the Arctic Coal Company, mined 7,500 tons of coal last winter. Work was directed, however, not so much to obtaining coal as to pushing the works beyond reach of the frost, and the main level is now about a half mile long. Work, this summer, is to be devoted entirely to the installation of machinery and regular coal mining will begin in October next. The production of coal, next summer, is expected to be 50,000-60,000 tons, all of which will be sent to Norway. The manager says that the coal is of excellent quality and that it may be mined at a small but reasonable profit.

Dr. Charcot's Antarctic Expedition. Dr. Bruce has sent to the *Scottish Geographical Magazine* (June, 1910), some further information concerning the scientific observations of the Charcot expedition. A series of soundings seem to show that the continental plateau in the neighborhood of Graham Land has a very irregular surface while Peter I Land apparently rises very abruptly from the ocean depths. A shallowing in Lat. 70° S. and Long. 119° W. perhaps indicates the vicinity of land, while a sounding of over 5,000 meters in Lat. 66° S. and Long. 118° W. indicates the presence here of a deep depression of the ocean floor.

Lieut. Filchner's Antarctic Plans. The *Zeitschrift* of the Geographical Society of Berlin (1910, No. 3), reports on the aims of the projected German Antarctic Expedition as announced by its leader, Lieut. Filchner. He has planned the undertaking, on the theory that the Antarctic land mass may be found to be divided into two parts by an arm of the ocean connecting Ross Sea on the Pacific, with Weddell Sea on the Atlantic side of Antarctica. *Nature* (May 12, 1910), commenting on the idea, says that "this possibility, and also the view that the Antarctic land south of the Pacific consists only of an archipelago, must have occurred to all who carefully considered the results collected by the expeditions

of Captain Scott and Sir Ernest Shackleton. The meteorological evidence and the apparently well-marked westward trend of the land which drove Sir Ernest Shackleton upon the South Polar plateau seem, however, not very favorable to the idea of the direct connection of the Ross and Weddell Seas. Indications of any such connection might also have been expected from the tidal observations of the Discovery." It is hoped that this question, which Prof. Penck has declared to be much more important than the discovery of the pole, will be settled by Lieut. Filchner by direct observation. There seems little doubt that funds will be raised for his enterprise. One unnamed donor has given 300,000 marks.

PHYSICAL GEOGRAPHY

Evolution and Outlook of Seismic Geology. Prof. W. H. Hobbs has recently shown (*Proc.* Amer. Phil. Soc. Vol. XLVIII, 1909, 1-44) that the natural development of seismology was long retarded by Mallet's theory of the centrum. The tectonic conception of earthquakes began with Suess in 1872. Various studies of faulting associated with earthquakes have led to the establishment of the fault block theory. The great work of de Montessus de Ballore culminates this development. The relation of earthquakes to volcanoes has not been well defined until recent times, and the conditions of earth strain during the growth of block mountains is still under discussion.

The outlook in seismology "indicates two lines of effort to be followed up. These are (1) to make practical application of the knowledge already gained, and (2) to investigate with every possible improvement in method until we have so laid bare the law of seisms that we may forecast the time, the place, and the probable severity of future earthquakes with at least as much accuracy and forewarning as is now possible in weather prediction." Earthquake forecasts, earthquake cycles, and possibilities of future prognostication are reviewed.

Climatological Work of the Weather Bureau. Some of the important problems in climatology which the Weather Bureau has under investigation are described by Professor F. H. Bigelow in the *Monthly Weather Review* for November, 1909. New charts of mean monthly and mean annual temperatures, reduced to homogeneous systems, are being constructed and published, which will make possible a far more accurate study, both of current temperatures and of temperature-departures. A new form of snow-bin, designed to give a fair catch of snow in mountainous districts which can be visited only at intervals, and to store the snow and rain until it can be measured, is being experimented with. The relation between runoff, seepage, discharges, floods, lags and flood-forecasts is being studied. Evaporation is being investigated at the Salton Sea, and elsewhere, and a formula is being developed which it is believed "will be applicable in all climates."

Problems connected with the general circulation of the atmosphere, especially in connection with seasonal forecasts; with the measurement of solar radiation, and economic questions relating to the damage done by floods, winds and waves are also suggested as important subjects for thorough investigation.

R. DeC. Ward.

Forests, Climate and Floods. Prof. Willis L. Moore, Chief of the Weather Bureau, has made a report on "The Influence of Forests on Climate and on

Floods" to the Committee on Agriculture of the House of Representatives. This report has been published as a pamphlet (Washington, D. C., 1910, Government Printing Office), and widely distributed. It appears, from a *Note* which is printed on the outside of the front cover, that the present argument resulted from a request of the chairman of the committee that Professor Moore should submit further information on this subject, the latter having already given some evidence before the same committee in 1909. That portion of the report which deals with forests in their influence upon climate is on the whole a fair presentation of the views generally held by meteorologists, but, in his discussion of the effects of forests and of deforestation upon floods and run-off, the author cannot be said to have stated the opinions which the majority of engineers maintain in this matter.

R. DeC. Ward.

Wind Observations in Relation to Aeronautics. That progress in meteorology means progress in aeronautics is a statement the truth of which few will care to challenge. Similarly, progress in aeronautics means progress in meteorology. The study of meteorological data which may be of practical use in aeronautics is advancing rapidly. Thus, in Germany, at the request of the "Motorluftschiff-Studiengesellschaft" of Berlin, Professor Assmann has recently completed an analysis of the wind data available for the Empire (*Die Winde in Deutschland,* Braunschweig, 1910, pp. 48). The percentage of frequency of wind from the eight principal directions is given for about fifty stations for the twenty years 1886-1905, together with a subdivision of winds from each direction according to estimates made on the Beaufort scale, and not as determined by the anemometer.

For Italy there is also a new publication on winds, prepared at the request of the Italian Aeronautical Society by Dr. Filippo Eredia, of the Central Meteorological Office (*I Venti in Italia,* Rome, 1909), and printed in the *Rivista Tecnica di Aeronautica Italiana.* Data are given for 111 stations as to wind direction, and a series of colored plates shows the results graphically. That such studies as these two will prove of great practical importance to those who are interested in aeronautics is obvious, and they will be equally important to meteorologists and climatologists.

R. DeC. Ward.

Corrigenda. As the author was unable to revise the final proof of the paper, "The Caverns and People of Northern Yucatan" (*Bulletin,* Vol. XLII, No. 5, May, 1910, pp. 321-326), certain errors need correction:

p. 323, explanation of Fig. 2, in third line change, "see Fig. 7" to read "see Fig. 9."

p. 325, explanation of Fig. 8, change the first word, "when," in line 7 to "where."

p. 325, third line below figure, change "Figure 4" to read "Figure 5."

p. 325, third line from bottom, change "Fig. 5" to read "Fig. 6."

p. 326, line 17, sentence beginning "Figure 3," change to read "Figure 4 may be taken to represent a section of the Ikil cenote, and Figure 3 as an intermediate stage," etc.

p. 330, explanation of Fig. 11, change "Photo by E. H. Thompson" to read "Photo by H. E. Sargent."

p. 333, explanation of Fig. 14, for "E. J. Thompson" read "E. H. Thompson."

p. 334, line 22, for "day" read "dry."

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

The Islands of Titicaca and Koati. By A. F. Bandelier. xvi and 358 pp., and 85 plates, including sketches, plans, maps and photographs. The Hispanic Society of America, New York, 1910.

In reading this scholarly book one is reminded of the remark recently made by a reviewer that "one after another the different domains of research seem to be creeping out of the twilight zone of campaign oratory." The world is full of descriptive books that pass as authoritative in the minds of the multitude even though the author is without an inch of standing room in his chosen field of work. Almost every globe trotter and casual traveler is not content until he has written his book, filled with twaddle though it may be; and not a few reputations are built upon such sands. Here is a man who did not ramble through a continent; he simply journeyed to the islands of Titicaca and Koati in Lake Titicaca, toiled long months at his task under dreary conditions, then returned to the even greater task of analyzing and comparing the books of the scholars. The result is a work that is erudite, authoritative, modestly written, substantial. One does not herald even the best books in the public places nowadays, but long after Bandelier has completed his work, centuries after, his book will be gratefully read and admired in the company of scholars.

An excellent historico-geographical description of the Titicaca drainage basin, with maps and topographic cross-sections, constitutes the opening chapter. As in all the succeeding chapters, the notes, collected into a separate section, are very full and of almost equal value with the text. They represent extended reading, critical examination, scholarly comment. A discussion of the physical aspect and general condition of the islands of Titicaca and Koati follows and is preparatory to the next, the most important, and the longest chapter of all, that on the Indian inhabitants of Titicaca. At every step there is comparison with the life conditions of related population groups on the mainland. The data were gathered under extraordinarily difficult conditions, as anyone is aware who has attempted to draw information from an Aymara Indian, which is almost equivalent to saying one has tried to draw blood from a stone. In the fourth chapter is a description of the ancient ruins on Titicaca, which were studied with great care, sketched, and in some instances mapped topographically. Of special interest are the conclusions concerning the ancient and modern terraces and the system of rotation of fields in vogue among the earliest inhabitants of the terraces. The system is still practiced through an annual allotment, by the native caciques, of the land that is to be cultivated. The large surface required under this system, and the long period of rest, or of fallowing, that follows a year of cultivation, has led in many instances to the erroneous conclusion that a large decrease

of population has occurred. The ruins of Koati and the aboriginal myths and traditions concerning the island of Titicaca are the subjects of research in the two last chapters of the book. There is an indication in one of the notes that the author will soon publish a more extended work on Bolivia, and the character of the book before us is ample ground for the cordial hope that it will be published soon.

ISAIAH BOWMAN.

Crete, the Forerunner of Greece. By Charles Henry Hawes and Harriet Boyd Hawes. Preface by Arthur J. Evans. xiv and 158 pp., map, plans, bibliography and index. Harper & Brothers, New York, 1909.

As the area for new discoveries over the earth's surface becomes from year to year more restricted and the legend *Terra incognita* is daily falling into disuse among the map-makers, man is forced to travel back, chronologically instead of longitudinally, if he would seek new lands and learn of strange peoples. The spade of the excavator is supplanting the oar of the mariner; and the traveller's tales brought back from buried years are hardly less wonderful and scarcely more credible than those which amazed our forefathers on the return of some early voyager. Fifteen or twenty years ago Homer and the Homeric age marked the day-spring of Greek civilization and the legendary date of the Trojan war stood like a boundary stone on an unknown and apparently unknowable chronological wilderness. But Dr. Evans and his fellow workers in Crete have changed all that, and this little book in Harper's "Library of Living Thought," by two of those workers is a record, up to date, of that change. How completely our earlier notions have been upset is evident from the start we receive on finding the Trojan War the last and closing date of a long and glorious chronology. The Year 1200 B. C. is so recent, so near to yesterday, that age upon age, period upon period, of human activity and progress, in government, commerce, architecture, art, and even in writing are set back of that time until we reach the Neolithic.

The book is a plainly written and evidently popular account of the discoveries in Crete on which this remarkable extension of our mental horizon backward into the origins of European life is based. The principal sites, the exhumed treasures, and the great palaces are described, and the old life of the Minoan people is set forth in considerable detail, even to the plumbing of their houses and the latest modes of the ladies' dress. A short preface by Dr. Evans himself assures us that the two authors speak with knowledge. An apology for a map is barely sufficient to enable us to locate the ancient sites, and leaves us happily free to fill in rivers and mountains, roads and railroads (if such exist) to our heart's content, thereby differing from the work of early chartographers who peopled their waste places with strange beasts and stranger names. In other respects the appearance of the little volume is good.

STEPHEN A. HURLBUT.

The Nitrate Deposits of Chile. By R. A. F. Penrose. *Jour. of Geol.,* Jan.-Feb., pp. 1-32, Chicago, 1910.

The much-discussed problem of the nitrate beds of northern Chile is here reviewed and some new light thrown upon it. After an introductory statement as to the history of the nitrate mining industry and the physical features of the nitrate region, the author discusses the mode of occurrence of the nitrate deposits

in Tarapacá and other nitrate regions. There is a long section describing the industrial methods employed in developing the nitrate deposits, the rate of production, and the uses of nitrate of soda. The final paragraph describes the nitrate deposits in other parts of the world.

Regarding the origin of the nitrates the author concludes that they were produced mostly from nitrogenous animal matter in old guano beds which once lined the waters of the interior basin. The guano deposits are assumed to have been formed as border accumulations during the time that the nitrate pampa was a part of the ocean floor and also during the later period when elevation of the region transformed it into an open bay or gulf and finally into an enclosed sea. In this view erosion is responsible for the disappearance of the guano since the leaching which gave rise to the concentrated nitrate. The occurrence of the nitrate in the form of sodium nitrate is attributed to the abundance of sodium salts in the region. Common salt was deposited upon the final evaporation of the waters of the enclosed sea. It is granted that a small amount of the nitrate may have been derived from the decay of marine and land vegetation about the borders of the tract. To the decay of marine plants is also attributed most of the iodine associated with the nitrate. The borates in the deposits are thought to have been derived from boron-bearing minerals and from springs carrying boron compounds. While these conclusions appear plausible the author admits that a vast amount of geological and chemical details must yet be worked out before the subject can be fully understood. ISAIAH BOWMAN.

Traité de Géographie physique. Par Emmanuel de Martonne. Completed in 4 parts. 1—Climat; 2—Hydrographie; 3—Relief du Sol; 4—Biogéographie. Parts 1 and 2, 412 pp., Photographs, Maps, Diagrams and Bibliographies. Librairie Armand Colin, Paris, 1909. 5 frs. a Part.

The author introduces this "Treatise on Physical Geography" with an interesting chapter on the evolution of the science from the geography of the ancients to that of the modern schools. On the basis of this review he proposes to define geography as the science of physical, biological and social phenomena, considered as to their distribution, their causes, and their mutual inter-relations.

The second chapter in the first part of the work discusses the form of the earth, its rotation and its revolution about the sun, and includes an interesting account of the effects which these physical phenomena have upon human conditions. Believing that no country is geographically known until a number of latitude and longitude determinations have made possible a proper map, and that the map is the basis of all geographic knowledge, the author devotes a chapter to a rather extended account of latitude and longitude determinations, including some description of the instruments used; and of the subject of map projections. He next presents a variety of miscellaneous matters under the title "the elements of physical geography." Here are treated such topics as the composition of the atmosphere, the distribution of lands and oceans, continental and oceanic reliefs, waves, tides and currents, terrestrial magnetism, internal heat of the earth, volcanoes and earthquakes, and the work of winds, streams, and glaciers.

Seven chapters are devoted to the subject of Climate. After a detailed account of the several factors of climate, in which are set forth the principal features of atmospheric temperature, pressure, and humidity, there follows a

discussion of "weather types," including an account of the changes due to cyclonic movements of the atmosphere, and such special phenomena as the cold waves of North America and the southerly bursters of Australia. The "principal climatic types" are treated under the general heads: equatorial, tropical, and subtropical climates, temperate climates with cold season, warm and cold desert climates, cold climates with temperate season, and polar climates. These are further divided in the detailed treatment covering some fifteen pages, and their distribution is shown on a colored map. In discussing the subject of climatic changes, the author expresses his doubt as to the verity of progressive dessication within the historic period. A chapter on mountain climate follows. While reading this part of the work, one is continually disappointed at the author's failure to present an adequate account of the economic aspects of climate. After reading the opening chapters, one is prepared to find in Part II a much more thorough treatment of the effect of climate on man than the text includes.

The next section is entitled "Hydrography," and the introductory chapter deals with the forms and depths of ocean basins, the temperatures and salinity of ocean waters. Then follows an account of waves, tides, and currents.. In discussing gulfs and mediterranean seas, the features characteristic of the more important examples are set forth in some detail, and the treatment becomes regional rather than systematic, in contrast with the method employed in most of the text. The topographic features of lakes are briefly described; several pages are devoted to the question of lake origin, while the temperature and movements of lake waters, and the variations of lake levels are treated more fully. Young, mature, and old lakes are described; but the relation of lakes to stages of stream development is not emphasized. The remaining chapter deals with rivers, and is largely devoted to what may be denominated the regimen of streams. Springs are discussed, and their relation to stream action is pointed out; the conditions affecting stream volume are set forth, and a classification of streams based on conditions of alimentation is elaborated by means of type examples. Such topics as stream development, the characteristics of meandering streams, and the beneficial and harmful effects of stream action, are omitted; the treatment of hydrography must therefore be considered both incomplete and uneven.

The next section of the work deals with land forms. Only two chapters of this part appear in the parts here reviewed. The first presents an account of the methods of map making; here one misses illustrations of contour and hachure maps, which would add much to the value of the text. The figure (160) used to explain the principle of curved relief is misleading, because the transparent block diagram is so constructed as to show a down-curved surface, whereas the contours projected from it represent an up-curved surface. In the second chapter, a discussion of the methods of determining mean elevations and other elements of land forms is followed by certain general considerations as to the importance of stream erosion and of climate in producing topographic forms. The work of ice, wind, and waves is briefly touched upon, and the work of the weather more fully treated. Excellent illustrations, including block diagrams, aid the understanding of the text.

It is perhaps unfair to offer general criticism before all parts of a work have been reviewed. But we may properly sum up our impressions of the details of treatment in the first half of the work. The reader must congratulate the author

for having brought together a great variety of interesting material, and for having presented it in a most readable text. The author's style is characteristically French in its clarity, and the few photographic illustrations are excellent. Among the errors which have crept into the text, one of the most noticeable appears in the explanation of the use of the pendulum to determine the form of the earth (Part I, page 34). In order to emphasize the fact that the force of gravity increases toward the poles and decreases toward the equator, the author states that 'the force of gravity increases as one approaches the centre of the earth, as has been proved by observations in mines;' whereas the reverse is the case. Probably the most serious criticism which should be offered is the markedly uneven treatment which mars the unity of the work. Some chapters place much emphasis on the economic aspects of physical features, while others practically ignore this phase of geography. Details of little geographic value encumber the text, and important topics are wholly omitted. These are unfortunate defects in a work which is excellent in most other respects. D. W. JOHNSON.

In Wildest Africa. The Record of a hunting and exploration trip through Uganda, Victoria Nyanza, the Kilimanjaro region and British East Africa, with an account of the ascent of the snowfields of Mount Kibo, in East Central Africa, and a description of the various native tribes. By Peter MacQueen. xiii and 402 pp., 64 plates from original photographs, map, bibliography and index. L. C. Page & Company, Boston, 1909. $3.

From the geographical point of view this is one of the best of the African hunting books because it gives so much good and accurate information about the east and central regions in which the author travelled. The incidents of the chase are numerous and varied enough to satisfy any Nimrod; and the various tribes, their lives and homes, and East tropical Africa under the white régime, are so well described that the book may be recommended to all readers both as entertaining and as edifying. To be sure, a little slip occurs, now and then. Victoria Nyanza may be said by the most recent surveyors to be larger than Lake Superior, but they are mistaken. The illustrations are excellent and most of them were taken by Mr. Peter Dutkewich, the author's companion.

Zur Meteorologie von Peru. Von J. Hann. Aus den Sitzungsberichten der K. Akad. der Wissens. in Wien. Mathemnaturw. Klass. Bd. CXVIII. Abt. II a., 90 pp., Wien, Nov., 1909.

With his characteristic skill and thoroughness, Dr. Hann has compiled and analyzed the meteorological records obtained at the various Peruvian stations of the Harvard Observatory during the years 1888-1895. The establishment of these stations was described, and the data obtained at them were published in the *Annals* of the Astronomical Observatory of Harvard College, Vol. XXXIX, Parts I and II and Vol. XLIX, Parts I and II, but the numerical results have never been subjected to mathematical analysis, and as originally printed left much to be desired. No one in the world was better fitted than Dr. Hann to undertake this task. He has critically studied the various more or less broken series of observations; has discovered and corrected various errors, and has obtained results which are full of interest and importance for the meteorology of Peru. The present monograph is distinctly meteorological rather than climatological; the methods of reduction and of computation are rigidly mathematical. Yet the

results obtained, in regard to pressure, temperature, humidity, precipitation, cloudiness and wind movement, will obviously be indispensable to those who are making a thorough study of the climatology of Peru. The distribution of the various stations, at different altitudes, including the famous Misti station (19,200 ft.), the highest in the world, and in the different climatic provinces, covers a wide range of meteorological phenomena, and throws light on many interesting points. To comment on these, even briefly, would unduly extend this notice. Dr. Hann has done American meteorology a distinct service in analyzing for us data originally secured through the financial support of an American benefactor, and by the splendid efforts of American scientists in Peru, viz.: Professor William H. Pickering and Professor Solon I. Bailey.

R. DeC. Ward.

Across Papua. Being an Account of a Voyage round, and a March across the Territory of Papua with the Royal Commission. By Colonel Kenneth Mackay. xvi and 192 pp., 40 plates from photographs, map and index. Charles Scribner's Sons, New York, 1909. $2.50.

Col. Mackay was chairman of the Commission sent by the Commonwealth of Australia to inquire into the conditions and methods of government of British New Guinea, now officially known as Papua. The Commission travelled through a large part of the Territory and its facilities for acquiring the best information were, naturally, of the best. The inquiry resulted in a report which is packed with valuable data.

The present book is given to a popular account of the territory as the author saw it. The reader gathers from it the general atmosphere of things, what the author has deduced from a study of details. He gets a general idea of the country, the adaptability of parts of it to produce trade commodities, the relations between the whites and blacks and the attitude of the natives towards the new régime, including labor. For the most part, the book treats, interestingly, of the Commission's wanderings in the New Guinea bush and the narrative is enlivened by many anecdotes and incidents.

The author found the natives, in a number of places, working well for the whites in the development of the rubber, cacao, copra, tobacco and other industries. He believes the missionaries are exerting a most helpful influence. They are proving that the blacks may be trained to produce good results in carpentry, joinery and other forms of skilled labor. Papua, also, is beginning to make war on the *anopheles* mosquito and marked improvement in health conditions is observed in some places. Col. Mackay has faith that Papua and her people will make progress and that the world will have use for their productions.

Fifty Years in Constantinople and Recollections of Robert College. By George Washburn, D.D., LL.D. xxxi and 317 pp., and Illustrations. Houghton Mifflin Company, Boston and New York, 1909. $3.

This book is much more than a history of the first forty years of Robert College. The events of the last fifty years, which led up to the recent revolution in Turkey, are summed up in the introductory chapter; and we are constantly reminded, while perusing this story of the vicissitudes and the development of Robert College, that it has a background of events and personalities that make it peculiar among all educational institutions. Dr. Washburn was, for many years,

closely associated with Robert College as director and president, and he writes from fullness of information of the ups and downs, the struggles, the trials and the triumph of this unique educational experiment.

The training and development of the physical, intellectual and moral powers of 2,500 boys of the East, so that these students, in the conspicuous places many of them have occupied, have long been recognized as representing a different type of manhood from that commonly seen in the Orient, is only one of the achievements of Robert College. It has revolutionized the policy of missionary societies with regard to education, and there are now many such institutions in different parts of the world. The college has also been influential in bringing about a less hostile state of feeling between the different races of the East, and it has had great success in winning the confidence of the surrounding Mohammedans. The author's fascinating story of the college is not cast in a precise historical vein, but is a record of personal recollections in which he speaks freely of events and personalities as they appeared to him.

Les Civilisations de l'Afrique du Nord. Berbères-Arabes-Turcs. Par Victor Piquet. ix and 392 pp. and 4 maps. Librairie Armand Colin, Paris, 1909. Fr. 4.

This book fills a need because it is the only work, in moderate compass, that gives the history of the northern part of Africa before the French occupation. Two or three learned works give much attention to various epochs of this history; and, at last, we have this little volume which concisely tells the whole story of the civilizations that succeeded one another in the large regions now known as Tunis, Algeria and Morocco. Broadly speaking, the complete history of North Africa should be divided into three parts: 1. The history of the peoples of Barbary (Lybians, Numidians and others) until the arrival of the Arabs; 2. The history of the Mohammedan governments until the establishment of the French; 3. The work of the French in North Africa. The first two periods are treated in this volume, and a part of the first period is considerably abridged because the history of the Roman rule in North Africa has been made well known in remarkable and standard works.

Many readers of this book will be especially impressed with the fact that, for many ages there was no political boundary dividing this wide home of the North African peoples. Frontiers cutting up the great area into different countries, is a comparatively modern and wholly artificial innovation. Even writers of to-day treat scientifically of the antiquities of Algeria without mentioning those of Tunis, which, nevertheless, was the cradle from which the successive civilizations of North Africa spread.

The work is based almost entirely upon the original Arabic chronicles, long extracts from which are given. The book is full of matter that is new even to the well read part of the public. It should be in every public library as the only work of the kind that has yet appeared and because it adequately treats its topic.

Die Blütenpflanzen Afrikas. Eine Anleitung zum afrikanischen Siphonogamen. Von Franz Thonner. xvi and 673 pp., 150 plates, map and index. Verlag von R. Friedländer & Sohn, Berlin, 1908. M. 10.

The author is an Austrian botanist. His recent field studies in his specialty have been carried on largely in the Congo basin. This large work, finely pro-

duced and splendidly illustrated, should be of much practical utility. The labors of many competent men have now made the flora of Africa very well known in all its characteristic features. It is highly desirable that travellers and colonists in Africa, as well as botanists in Europe and America, should be provided with a book that will enable them to determine the names, or at least the species of the African plants that interest them. This helpfulness will be found in Mr. Thonner's book. It includes all the species of the flowering plants that are now known in Africa and its islands. The author arranges the plants in 221 families. Under his description of the general characteristics of each family, he gives a paragraph to each of its species, describing it, and giving its habitat, its uses, if any, and referring to the appropriate plate, if the plant is illustrated. He has, of course, drawn largely upon the results of other botanical specialists in the African field.

The Autobiography of Sir Henry Morton Stanley. Edited by his wife, Dorothy Stanley. xvii and 551 pp., 16 photogravures, map, and index. Houghton Mifflin Company, Boston and New York, 1909. $5.00.

Stanley was a masterful man, full of natural resource, well fitted by nature to be the leader of a military campaign or the revealer of a continent. He undertook some of the hardest tasks that ever fell to human lot and his genius helped him to carry to a successful end everything he ever attempted to do. He had many friends and many severe critics. No man ever more highly praised his subordinates, white or black, who had it in them to perform their duty well; but he had no patience with incompetency, no use for the man who fell short of the mark and could not perform the task assigned to him. It was the men who failed in his service that wrote bitterly of him and his work and most that they said was not true. In his long career as an African explorer, he steadily improved in the quality of his work, for, at the outset, he had no training for scientific exploration. His map of the Congo as he followed it to the sea is, in all its large features, practically the map of the Congo as we know it to-day. If we sum up all his voluminous writings on Africa to express, in a word, their value to the world, we may simply say that Stanley told the truth. And he soon grew to share Livingstone's perfect faith that there was good in Africa and in its peoples that every proper influence of civilization should help to foster and develop. Livingstone and Stanley were the men of faith and inspiration who set on foot the great African movement that has brought to light nearly every corner of the continent and is making such wonderful progress in the work of development since the era of pioneer exploration closed.

Most of this book is Stanley's own narrative of his life and work. Here, for the first time, we have the complete story of his life. With his deep sincerity, wonderful self-revelation, and remarkable literary style, he makes the reader see the babe in the cottage cradle, then the grim workhouse, the squalid life in Liverpool, the terrible experiences at sea, the dawn of freedom in America, where he was adopted by a New Orleans merchant; then his life as a planter, his enlistment in the Confederate Army, the wonderful picture of Shiloh, and his life in prison and escape. From his journals, notes, letters, speeches, etc., it has been possible to continue the story of his life largely in his own words—his return to England and experiences in journalism; the finding of Livingstone, exploration of the Dark Continent, the founding of the Congo State and the

rescue of Emin; and finally his Parliamentary career and closing years. His journals and private letters bring out the inner history of many important events and episodes which have not hitherto been made public.

Among the fine illustrations are seven portraits of Stanley at different periods from his childhood to within four years of his death. So much of his life was absorbed by Africa that we may regard this remarkable autobiography as a rich contribution to the literature of the great continent to which he gave so unstintedly his wonderful energy of mind and body.

Cyrenaica. Report on the Work of the Commission sent out by the Jewish Territorial Organization, under the Auspices of the Governor-General of Tripoli, to Examine the Territory Proposed for the Purpose of a Jewish Settlement in Cyrenaica. By J. W. Gregory and Others. xiii and 52 pp., Maps, Illustrations, and Appendix. Ito Offices, London, 1909.

Cyrenaica is the large projection of land on the northern coast of Africa between Egypt and the Great Syrtis. The Jewish Territorial Organization, of which Mr. Israel Zangwill is president, conceived the idea, that this land, reputed to have once been populous and rich, might afford a comfortable home for many of those Jews who cannot or will not remain in the lands in which they at present live. The Organization accordingly sent out an expedition, led by Dr. Gregory, Professor of Geology at the University of Glasgow, to examine the territory proposed for a Jewish settlement. The work of the expedition was thoroughly performed, but the results were disappointing so far as the colonization project is concerned. The report includes a careful estimate of the water supply based upon the rain-gauge at Benghazi and also on the limited yield from the few springs on the plateau and from a study of the beds of the hill streams, many of which, evidently, cannot have carried water down them for many years. It seems to be proven conclusively that, owing to its lack of water, Cyrenaica could never have maintained a very large population. There is considerable rainfall, but the porosity of the soil has made the water largely unconservable and irrecoverable.

While the report is unfavorable to the hopes of those who are promoting the cause of Jewish colonization, it is a valuable contribution to geography. It carefully describes in its geographical, hydrographical, climatic and economic aspects, a region of which very little was known. It is introduced by an historical and political preface by Mr. Zangwill.

Man in Many Lands. Being an Introduction to the Study of Geographic Control. By L. W. Lyde, A.M. vii and 184 pp., and 24 illustrations in colors. Adam and Charles Black, London, and the Macmillan Company, New York, 1910. 65c.

Professor Lyde has shown in his excellent textbooks that he has a talent for tracing the relation between life and its geographic environment. The present work is of the nature of a geographic reader for students in the secondary schools. We do not recall having seen elsewhere in the same compass and for the perusal of young students, a treatment so large and so illuminative as this, of the subject of geographic control. No boy or girl can read the book without pleasure and edification or hardly fail, in all later reading, to look for the influence that

the inorganic exerts upon the organic. Some of the author's assertions, however, are not convincing, as where he undertakes, for example, to explain what he calls the "twang" in the pronunciation of English in some parts of our country; and some of his statements appear too sweeping and might better have been omitted.

He speaks of conditions in a certain island that "have bred a most quarrelsome spirit among the people so that they are more notorious now for their vendettas than for anything else." This is true, but the guide books unanimously invite tourists to this island, for it has remarkable beauty and interest; and John Mitchel Chapman, who has visited it many times and has written one of the latest books on it, says of the inhabitants that "to the stranger they are the most kindly, the most courteous and the most hospitable people imagination can picture." The author should either have written more or nothing, for the impression he makes is not wholly just. Again, he speaks of one of the great nations as "cursed by political and ecclesiastical tyranny." A phrase like this, practically unqualified, should not be placed before a young student, in his school.

The very fine illustrations hold truth up to nature as the pictures in few school books do.

Pre-Historic Rhodesia. An examination of the Historical, Ethnological and Archæological Evidences as to the Origin and Age of the Rock Mines and Stone Buildings, with a Gazetteer of Mediæval South-east Africa, 915 A. D. to 1760 A. D., and the Countries of the Monomotapa, Manica, Sabia, Quiteve, Sofala, and Mozambique. By R. N. Hall, co-author of "The Ancient Ruins of Rhodesia" and author of "The Great Zimbabwe, Mashonaland." With Illustrations, Maps and Plan. George W. Jacobs & Co., Philadelphia, 1909. 8vo. $3.50.

"Pre-historic Rhodesia is the first instalment of the reply to Professor Maciver's conclusions." In these words the author throws down the gauntlet inviting battle, for it is not probable that Professor Maciver, whose conclusions are directly opposed to those of Mr. Hall, will fail to reply warmly to the vigorous challenge of this attractive volume written with authority and straightforwardness. Mr. Hall does not equivocate. We understand exactly what he means with every line. While speaking most respectfully of Professor Maciver and his conclusions as set forth in "Mediæval Rhodesia" and in certain papers read before societies, Mr. Hall proceeds to grind them into the dust. The battleground is Southeast Africa—the region south of the Zambezi river—where extensive ruins of stone buildings long have been known to exist, but have been scientifically noticed only of late years. The chief problems which are to be settled are age and origin. Who were the builders and when; why constructed and why abandoned so long ago that there is no native knowledge or tradition of the builders or occupants? Mr. Hall and Professor Maciver differ entirely on the enigma, the latter asserting positively that there was no intrusion of foreign influence into this region, now called Rhodesia, earlier than the eleventh century A. D., and that the greatest ruin, of all that have so far been noted, the Zimbabwe Temple, is certainly not earlier than the fourteenth or fifteenth century A. D., which Mr. Hall declares to be impossible, because "had it been

built in 1500, the Moors must have seen it before it was erected, which amounts to a *reductio ad absurdum*." Mr. Hall places the date of the building prior to 610 A. D. and also claims that it is later than the rock-mines from which enormous quantities of gold were taken.

Professor Maciver holds that the buildings were the work of natives without extraneous aid, "a negroid or negro race of African stock" and that the rock-mining was done by the same people; that is to say, the whole development to be found here was the result of the evolution of certain native stocks. Mr. Hall, on the other hand, assures us that this could not be the case and gives many reasons for his belief. He is sure from his examinations that the works are to be ascribed to Arabs, Persians and Indians who came before the dawn of the Christian era after the gold. They came by sea and entered by the valley of the Sabi river, in whose upper drainage basin and in that of the adjoining Limpopo the mines and ruins mainly occur. There are three or four classes of the ruins, according to Mr. Hall, some belong to remote pre-historic times, some to mediæval and post-mediæval, and some crude walls to the modern Ma-Karanga tribe. He classes the mines in the same way. The area covered is over 400,000 square miles, and as only a small part is accessible by railway, the difficulties in the way of complete exploration are great. "Not a single one of the hundreds of ruins has as yet been examined. Not a tenth part of the Zimbabwe Temple has been explored." From this it is apparent that the time for positive statement of any kind concerning the ruins or the mines has not arrived.

There is nothing improbable in Professor Maciver's contention, and the same may be said of the claims of Mr. Hall. It is estimated that more than $375,000,000 in gold was taken from the rock in this region in pre-historic times. What has become of it? On the lowest floor of some of the ruins examined, manufactured ornaments of pure gold have been found thickly strewn, and rich finds in this line await the explorer everywhere, no doubt, but this would hardly account for the vast amount of gold mined. In the introduction to a former book by this author (Great Zimbabwe) Dr. Keane suggested that the Rhodesia region was the land of Havilah, and that the structures and mining were the work of the South Arabian Himyarites, followed in the time of Solomon by the Jews and the Phœnicians. The "gold of Ophir" was the gold brought to Ophir from what is now Rhodesia, for exchange.

The usual tendency is to enshroud unknown ruins and the unknown builders with a pall of mystery which eventually is swept away by the truth, as we have seen on this side of the water in the cases of the Moundbuilders, the Mayas and even the Cliff-dwellers. It is more romantic to believe the ruins of Rhodesia to have been built by pre-Koranic gold-hunting Arabs than by common natives merely working out their own fate.

Judging from the pictures in this book there is nothing about the Rhodesia ruins that is evidence against Professor Maciver's theory. The walls are simple, they seem to be of dry-masonry, the ornamentation is meagre and primitive, and the few carvings found are also primitive. So far the evidence seems to indicate a low grade of culture for the builders. Fragments of Nankin china, certain iron and copper articles, as well as the gold, have been found. Some of these are recent intrusions, especially the china which Professor Maciver

adduces as evidence of the comparatively modern construction of the buildings, while Mr. Hall maintains that none of it has been found in a position that would warrant such an inference.

The volume is exceedingly interesting and the questions involved bear on some of the most romantic pages of the far past. There are illustrations from photographs, and maps of the region under discussion, and a plan of the Zimbabwe temple to aid the reader. The subject is very well and clearly presented from Mr. Hall's point of view.

Opinions Chinoises sur les Barbares d'Occident. Par Com't. Harfeld. viii and 308 pp. and many illustrations. Albert Dewit, Brussels, 1909.

A unique book. The author recently lived in China for four years as a civil engineer in European service. He met many of the educated natives and endeavored, with considerable success, to draw them out on questions relating to the inner life and thought of the Chinese, their own ideas concerning their country and government, their relations with other peoples and their views on western civilization. The son of Han is not an open book, but the author really succeeded in getting hold of many of his points of view. About a third of the book is given to the opinions of a high Chinese official. China for the Chinese, he maintains, is the only policy his people should uphold. He gives a long list of China's grievances—the harmful influences of the privileges accorded to foreign merchants, the wicked infliction of India's opium upon China, the territorial concessions forced from the Chinese government, the laws against Chinese immigration in western lands, the cruelties inflicted upon Chinese coolies by foreigners, the abuse of the western newspaper press, the utter failure of the western world to understand the genius, the spirit and ideals of the Chinese, and so on. About 40 pages are given to the grievances of the Chinese against the missionaries.

Another section is given to Chinese criticisms of western nations, including their administrative and financial scandals, the high barriers that separate the classes, nepotism, anarchism, great standing armies, etc.; coming to smaller detail the Occident is censured for its waste of forests and other natural resources, its towering buildings, the ridiculous attire of its men and women, and its social habits, many of which violate good taste and propriety. The book is entertaining reading and the author has apparently striven honestly to enable us to see ourselves as some, at least, of the Chinese see us.

The Government of the People of the State of Michigan. By Julia Anne King, M. A. Revised edition. Hinds, Noble & Eldredge, Philadelphia, (1896). 50 cents.

This is an excellent historical sketch of the government of Michigan from the earliest European occupation of the region down to the present day, for the use of schools, but it is also a good handbook for library use. The constitution of the State is printed in full and an appendix gives a part of the ordinance of 1787; "An ordinance for the government of the Territory of the United States Northwest of the river Ohio," which was preliminary to the formation "of not less than three nor more than five states from the said territory." This was the "North-west Territory" whose history forms one of the most interesting parts of the story of the growth of the United States.

Diamonds. By Sir William Crookes, LL.D., D. Sc. xvi and 146 pp., and 24 illustrations. Harper & Brothers, New York and London, 1909. 2s. 6d.

Probably no one could write better on this subject than the great chemist whose name is on the title-page, not even Mr. Gardner Williams, who is credited by the author with knowing "more about diamonds than any man living." Besides most carefully studying the diamond in so favorable a place as South Africa, where he made two visits, Sir William has himself produced diamonds artificially from molten iron. Manufactured diamonds, however, are microscopic, the largest made being less than a millimetre across. Not till pressure and temperature can be obtained and maintained sufficiently high to liquefy and solidify carbon in considerable quantity can a diamond of some size be expected from the furnace.

In this little book Sir William, besides describing the South African mines, discusses the possible method of the formation by natural process of the diamond, as well as the method of artificial manufacture. The Canyon Diablo (Arizona) meteorite diamonds are likewise described and illustrated. Though the volume is small, it contains much more real information on the subject discussed than many a larger volume does; and it is presented clearly.

Sir William says: "I have done my best to explain the fiery origin of the Diamond, and to describe the glowing, molten, subterranean furnaces where they first begin mysteriously to take shape. I have shown that a diamond is the outcome of a series of Titanic earth convulsions, and that these precious gems undergo cycles of fiery, strange, and potent vicissitudes before they can blaze on a ring or a tiara."

Terry's Mexico. Handbook for Travellers. By T. Philip Terry. ccxl and 595 pp., two maps and 25 plans. City of Mexico, Sonora News Co.; Houghton Mifflin Co., New York, 1909. $2.50.

Made on the general model of Baedeker, this is an admirable guide-book; the best in the field on the subject. It contains very full information on hotels, railways, tips, customs duties, shops, health, photography, etc., as well as good descriptions of towns, churches, boundaries, literature and all the other points expected in a guide-book but not always found there. In the extensive historical sketch Mr. Terry follows the lead of our romantic Prescott, speaking of Montezuma as "King" and further on of another chief as "Emperor." The style is agreeable and no traveller can afford to go to Mexico without this book, while it will be found an important reference volume for any library.

India of To-day. By Syed Sirdar Ali Khan. v. and 132 pp. Small 4to. Bombay Times Press, 1908.

The author says "the situation in India to-day is growing steadily worse and worse." Unrest and violence dominate the land, with no prospect of a near solution of the problem. In the judgment of some the difficulty has arisen through a too "soft-hearted" policy, and the remedy lies largely in a firmer rule. The author speaks in the highest praise of Lord Morley and declares he is the only member of the Government "capable of guiding the destinies of India through the present crisis." He believes that, widespread though the seditious spirit is, "it is possible once more to gather into the fold of loyalty all except the irreconcil-

ables—those who have found a new remunerative profession in disloyalty and who must be repressed and crushed at all costs." He adds that the British cannot leave India; their departure in any near period would mean immediate chaos. India, he affirms, is as little fitted for self-rule to-day as she was when the British first came. The British made an Empire out of heterogeneous populations and order can only be maintained by continuance of British rule. He believes in administrative reform, and the extension of the popular principle, but under British rule. An appendix gives the essential features of the Government of India's reform scheme.

A Discussion of Australian Meteorology. Being a Study of the Pressure, Rainfall and River Changes, both Seasonal and from Year to Year, together with a Comparison of the Air Movements over Australia with those over South Africa and South America. By William J. S. Lockyer. Under the direction of Sir Norman Lockyer. vii and 117 pp., Maps, Plates, and Appendix. Eyre & Spottiswoode, Ltd., London, 1909. 5s.

Begins with a brief account of the similar barometric changes that occur over the whole of Australia from year to year; summarizes the main features of Australia meteorology; the mean annual pressure and variations are shown and compared in order to determine their seasonal distribution; the changes from year to year of the pressure and rainfall are next compared and deductions are made with regard to the frequency of "southerly bursters;" the variation in the heights of river gauge readings on the Darling and Murray rivers are adduced as evidence to corroborate the rainfall changes; the results obtained from the data used to determine changes of long duration from barometric and rainfall statistics are summarized; the relation of Australian pressure changes to variations in other parts of the world, chiefly South America, South Africa and India, is discussed; and some facts are given which point to the similarity of air movements over South America, South Africa, South Indian Ocean and Australia. The whole discussion is based chiefly on the comparison of curves.

In an Unknown Land. A Journey through the Wastes of Labrador in Search of Gold. By Edward Colpitts Robinson. Introduction by Dr. Wilfred T. Grenfell, C.M.G. Small 8vo. London, Elliot Stock, 1909. 75 cents (3 shillings).

Labrador, though the first land on the American continent known to have been visited by Europeans (in the 10th century), remains still the unknown land. The Icelanders were not colonizers, nor were conditions ripe for settlement on this continent at that time, especially in Labrador, which even now is inhospitable. Its rivers are still mainly unknown, its mountains unclimbed, its vast forests untrodden. Dr. Grenfell predicts in the preface that one of these days we shall learn that, after all, Labrador is "one of God's countries, and therefore is an asset of no mean value." Naturally, the explorer and settler leave the least attractive till the last, but the crowding of populations in time will force settlements to the most forbidding places on earth. It is not surprising that Labrador has been left when the vast acreage of the more salubrious regions of the United States and Canada have been open. Mr. Robinson believes there is a "big future before inland Labrador," with its extensive forests, fine harbors, game, and pelts, and the undoubted mineral riches of the country. When we remember

that little children are now daily going to school in the North-west provinces of Canada in winter temperatures that a few generations ago were the terror of hardy explorers, we realize what systematic settlement in Labrador, with abundant food and shelter, may accomplish. Occupation of a region depends chiefly on the food question, and with railways in Labrador a population can be maintained there in working the resources, even if no foods can be obtained from the soil. Forethought is needed in cold regions, but otherwise they are in many ways preferable to tropical lands. Do away with the mosquito and the fly of the north and there is nothing uncomfortable or dangerous there. Dr. Grenfell has introduced the reindeer into Labrador, and as the moss and subsistence for this animal are abundant, there is no reason why it should not thrive as well here as in Alaska, where it is now domesticated. It is preferable to the dog as a traction animal and, besides, adds to the food resources. The dog must go, as it destroys the reindeer, is intractable, and more or less dangerous to man, Dr. Grenfell, himself, having had an experience with them never to be willingly repeated.

Cannes, Grasse, Juan-les Pins, Antibes. (Guides Joanne.) 69 pp., 12 photo-engravings, 2 plans and 3 maps. Hachette & Co., Paris, 1908. 1 fr. [A comprehensive and reliable guide to the many attractions, hotels, roads, etc., of these popular winter resorts.]

Das Problem der Entwicklung unseres Planetensystems. Aufstellung einer neuen Theorie nach vorhergehender Kritik der Theorien von Kant, Laplace, Poincaré, Moulton, Arrhenius u. a. Von Dr. Friedrich Nölke. xii and 216 pp., 3 figs. in text. Verlag Julius Springer, Berlin, 1908. M. 6. [A discussion of the various theories of the development of our planetary system fills nearly half of the book. The author's theory is based upon a new treatment of the nebular hypothesis, and he endeavors to trace our planetary system, in its present differing phases of development, back to its origin.]

Animal Figures in the Maya Codices. By Alfred M. Tozzer, Ph.D., and Glover M. Allen, Ph.D. Papers of the Peabody Museum of American Archæology and Ethnology, Harvard University, Vol. 4, No. 3. pp. 280-372, 30 plates, 24 illustrations in the text and bibliography. Published by the Museum, Cambridge, Mass., 1910. [A contribution to the study of Maya hieroglyphic writing. Dr. Tozzer prepared the paper on the interpretation of these conventionalized animal figures and Dr. Allen aided in the identification of the various species of animals that, under varying forms are used in connection with the glyphs.]

Schneiders Typen-Atlas. Naturwissenschaftlich- Geographischer Bilder-Atlas für Schule und Haus. Sechste Auflage. Farbige Ausgabe. C. C. Meinhold & Söhne, Dresden, 1910. M. 5. [This important work for schools was prepared by Prof. Dr. Oskar Schneider with the assistance of other specialists. There are 16 colored plates. On ethnographic, zoologic and botanical maps of each continent are printed numerals referring to the pictures; thus the student is supplied with data showing the distribution and appearance of the races, animals and types of the flora, on each continent.]

Cinquante Histoires d'Extrême-Orient. Mises en français, d'après les textes malais annotées et précédées d'un coup d'œil sur la Malaisie. Par Albert Mersier. 170 pp. Société Générale d'Impression, Paris, 1908. Fr. 3.50. [The

author presents here in French extracts from various Malay texts including works of the imagination, narratives, fables, history, etc. The curious and instructive little book is very entertaining and throws light upon the inner life of the Malayan peoples.]

Sudan Almanac, 1910. Compiled in the Intelligence Department, Cairo. 99 pp. Harrison & Sons, London, 1910. 1 s. [Contains many tables and notes relating to the Anglo-Egyptian Sudan. Five pages are given to the principal articles of barter in various parts of that region.]

Étude géologique et minière des Provinces chinoises voisines du Tonkin. Par M. A. Leclére, Ingénieur en Chef des Mines. 219 pp., and many photo-engravings and maps. Vve Ch. Dunod, Paris, 1902. [A valuable study of the geology and mineral resources of the Chinese territory adjoining Tonkin.]

Recuerdos de la Campaña del Acre de 1903. Mis Notas de Viaje. By Dr. Elias Sagárnaga. 194 pp. La Prensa de José L. Calderón, La Paz, 1909. [A good account of events and experiences in Bolivia's campaign against the gold seekers who attempted to establish the Republic of Acre in the northern part of that country.]

The Arctic and Antarctic Regions and the Law of Nations. By Thomas Willing Balch. Reprinted from *The American Journal of International Law,* April, 1910, pp. 265-275. [The author says that "the rules of the Law of Nations that recognize the freedom of the high seas would seem to apply naturally to a moving and shifting substance like the North Polar Sea ice at all points beyond the customary three-mile limit from the shore." The region around the South Pole is land, not a deep sea as at the North Pole. "But discovery alone is not sufficient to give a good title to a new, unoccupied land. The custom among nations for centuries, that gradually crystallized into a part of the Law of Nations, is that in order to perfect the right given by discovery, it must be followed by occupation." The author quotes many authorities in his lucid paper, and cites the case of Spitzbergen to which no nation has successfully asserted a claim of possession, so that those islands are now regarded as a joint possession of all mankind. Norway has recently invited the governments of other nations to send delegates to a conference at Christiania, this year, to arrange for the application of civil law and order in that archipelago. He concludes: "On general principles it would seem that both East and West Antarctica, two lands so much more difficult for man to occupy than Spitzbergen, should, following the liberal policy that has come to prevail in the case of Spitzbergen, become common possessions of all the family of nations."]

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NEW MAPS

NORTH AMERICA

U. S. GEOLOGICAL SURVEY MAPS

ALASKA. (a) Reconnaissance Map of Headwater Regions of Nabesna and White Rivers, Alaska. 1:250,000=3.95 miles to an inch. 141°-144° 10′ W.; 61° 35′-62° 53′ N. Contour interval, 200 feet. Topography by D. C. Witherspoon, T. G. Gerdine and S. R. Capps. Surveyed in 1902 and 1908. [Plane table triangulation with possible error of 2′ in latitude and 3′ in longitude. This is the region of the Nutzotin Mts. which adjoins the Wrangell Mts. on the northeast.] (b) Geologic Reconnaissance Map of Headwater Regions of Nabesna and White Rivers, Alaska. 1:250,000. Geology by F. C. Schrader, F. H. Moffit, A. Knopf and S. R. Capps under the direction of A. H. Brooks. [Geologic features imposed in colors on the topographic sheet, with gold and copper locations marked. These maps illustrate *Bull.* 417, "Mineral Resources of the Nebesna-White River District," by F. H. Moffit and Adolph Knopf, with a Section on the Quarternary by S. R. Capps, 1910.]

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, June, 1910.

Pilot Chart of the North Pacific Ocean, July, 1910.

U. S. DEPARTMENT OF AGRICULTURE MAPS

UNITED STATES. Soil Survey Maps of Etowah Co., Ala.; Hancock Co., Ga.; Caswell and Pitt Cos., and the Lake Mattamuskeet Area, N. C.; Center Co., Pa.; Coffee Co., Tenn. 1:63,360 and 1:62,500. [Issued by the Bureau of Soils with the co-operation of the several States. Each map is accompanied by descriptive text.]

GEORGIA. (a) A Preliminary Geological Map of Georgia. No scale. [Nine tints to show geological formations.] (b) Georgia Hydrographic Basins. [A black sketch map.] Illustrate *Bull.* 23, "A Preliminary Report on the Mineral

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Bolivia-Peru. Mapa de la regíon discutida entre Bolivia y el Perú en el que se señalan las diversas pretenciones de los dos Estados, las líneas Gomez-Polar y la del laudo argentino. Por Adolfo Ballivian. 1:2,000,000=31.56 miles to an inch. Bolivian Government, La Paz, 1909. [The data relating to the boundary line include the demarcation proposed by the Argentine Commission, but the map was made before the final adjustment of the dispute between Bolivia and Peru by the Treaty of La Paz, Sept. 17, 1909, whose results were mapped in the *Bulletin* for June.]

Dutch Guiana. (a) Overzichtskaart van Suriname. 1:2,000,000=31.56 miles to an inch. [Shows triangulation net, regions not yet explored, native paths, etc.] (b) Bovenstroomgebied van de Suriname. 1:199,200=3.1 miles to an inch. By J. G. W. J. Eilerts de Haan. Illustrate paper "Verslag van de expeditie naar de Suriname -rivier," in *Tidsch.* of the Roy. Netherlands Geog. Soc., Vol. 27, No. 3, Amsterdam, 1910. [Gives results of the detailed surveys of the Pikien and Gran Rivers, which unite to form the Surinam R.; also profiles of both rivers with 10 fold exaggeration of the vertical scale.]

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gives the provincial and district headquarters and much other political information, the distribution of mission stations, etc. The condition of communications is clearly represented. The best roads are well graded and bridged, average 15 feet in width, and, where metalled, are suitable for heavy traffic. The third class roads are native paths, straightened and cleaned, averaging 8 feet in width, and, in nearly all cases, they may be cycled over. The hill features are well shown in brown contours and all the telegraph lines and stations are indicated. The superior mapping of the large amount of survey material supplied reflects much credit upon the Stanford map-house.]

ASIA

CHINA. Itinéraire de M. Pelliot du Turkestan russe au Kan Sou. No scale. Illustrates paper "Trois ans de Mission dans la Haute Asie," by Paul Pelliot, in *Bull.* Soc. de Géog. de Lille, No. 4, Lille, 1910. [A black sketch map of the explorer's route from Andijan, in Russian Turkestan, across Chinese Turkestan to the province of Kan-su in China proper.]

INDIA. Geological Sketch Map showing the Manganese Ore Deposits of the Nágpur-Bálághát Area, Central Provinces. 1 inch=4 miles. *Memoirs* of the Geol. Surv. of India, Vol. 37, Part 4, "The Manganese Ore Deposits of India." Calcutta, 1909. [In colors.]

INDIA. (a) India. Showing Stations of Observation of the Magnetic Survey. 1:5,000,000=78.9 miles to an inch. *Extracts* from Narrative Reports of Officers of the Survey of India for 1905-6. Calcutta, 1908; (b) A map giving similar data for the Magnetic Survey of India, in 1906-7, is published in *Extracts,* etc., for 1909.

INDIA. India. Three maps showing the Progress of the Imperial Surveys in India to Oct., 1906, Oct., 1907, and Oct., 1908. 1:8,110,080=128 miles to an inch. In *General Reports* of the Survey of India for 1905-6, 1906-7, and 1907-8. Calcutta, 1907-8-9. [Shows in colors the work in progress or completed of the topographic and revenue surveys.]

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AUSTRIA-HUNGARY. Karte der Meer und Hafenfernen von Österreich-Ungarn. 1:5,000,000=78.9 miles to an inch. Illustrates paper by Prof. Dr. J. Kiesewetter in *Pet. Mitt.,* Vol. 56, No. 4, Justus Perthes, Gotha, 1910. [Red lines drawn across the Empire and the Balkan Pen. show distances along them from ports; blue lines, distances from the sea.]

AUSTRIA-HUNGARY. Semmering-Gebeit. 1:100,000=1.5 mile to an inch. G. Freitag & Berndt, Vienna, 1910. [One of the excellent small maps of districts especially attractive to tourists, with routes in red and descriptive text on the reverse.]

AUSTRIA-HUNGARY. Das Verbreitungsgebiet der deutschen Sprache in Westungarn auf Grundlage der Volkszählung vom 31 Dezember, 1900. Blatt I: Gespanschaft Oedenburg. 1:200,000=3.1 miles to an inch. By Dr. Richard Pfaundler. Illustrates paper of same title in *Deutsche Erde,* Vol. 9, No. 2, Gotha, 1910. [Shows in colors the percentages of German and other population in the area mapped.]

GERMANY. Kartenskizzen zur Siedlungsgeographie Württembergs. 4 maps on 1 sheet. 1:1,000,000=15.78 miles to an inch. Illustrate "Die ländlichen Siedlungsformen Württembergs," by Dr. R. Gradmann, in *Pet. Mitt.,* Vol. 50, No. 4, Justus Perthes, Gotha, 1910. [Map 1 shows settlements with symbols to indicate geographical influences that helped to determine their location; 2, Pre-Roman Settlement; 3, Roman Settlement; 4, German Settlement after the dislodgement of the Romans.]

ENGLAND. The Basin of the Thames. 1:190,080=3 miles to an inch. 2 sheets. Constructed and Engraved by W. & A. K. Johnston, L't'd., Edinburgh and London, 1910. 9s in sheets. [A school wall map with 7 tints of brown to show elevations above the sea for every 100 feet to 800 and over; railroads and the old Roman roads are in red, clearly showing how the directions they take were influenced by the topography. The names of valleys and other physical features are printed but only the larger towns are indicated by place mark and initial letter, so that there is no overcrowding, and attention is not distracted from the forms of the land, the purpose of the map being to facilitate the study of the physiography of the Thames basin. Of late years, British publishers have produced a considerable number of excellent school wall maps of this kind. Good physical maps, like this one, of parts of our own country in which the government topographic sheets, the essential basis of such maps, have been completed, would supply a very desirable facility for schools.]

FRANCE. Die Besitzverhältnisse des französischen Eisenbahnnetzes nach der Verstaatlichung der Westbahn-Linien. 1:3,700,000=58.3 miles to an inch. With inset of Paris in 1:600,000. *Pet. Mitt.,* Vol. 56, No. 4, Gotha, 1910. [The state rail routes are distinguished from those in private hands and the color of each road refers to its name or its terminal points as explained in the legend.]

OCEANIA

GERMAN NEW GUINEA. Der Kaiserin-Augusta Fluss. Aufgenommen von Kapitän u. Offizieren des Dampfers "Peiho" Mai-Juni, 1909. 1:200,000=3.1 miles to an inch. Illustrates "Eine Bereisung des Kaiseren-Augusta-Flusses," by Dr. O. Reche, in *Globus,* Vol. 97, No. 18, Brunswick, Germany, 1910. [A detailed chart (black and white) of the lower part of this large river for nearly half of its course. The scale is large enough to show all the river windings, a large number of soundings are given in meters, and the plantations, villages, swamps and nature of vegetation along the river are indicated. A careful product of survey work, especially noteworthy as the main purposes of the expedition were ethnographical and anthropological.]

NEW POMERANIA. Aufnahmen auf der Gazelle Halbinsel. 1. Der nordöstliche Teil der Gazelle Halbinsel. 1:200,000; 2. Plan des Alten Kraters (Balanakaia). 1:15,000; 3. Der Innerste Teil der Offenen Bucht. 1:200,000; 4. Übersichtskarte. 1:2,000,000. Illustrates "Beiträge zur Kenntniss Neu Pommerns und des Kaiser-Wilhelms-Landes," by Prof. Dr. K. Sapper in *Pet. Mitt.,* Vol. 56, No. 4, Justus Perthes, Gotha, 1910. [The maps are based upon the surveys of Dr. Sapper, Dr. G. Friederici and W. Wernicke. Their routes are given and colors are used to show grasslands, forests, mixed grassland and forest, mangrove and European plantations.]

Philippine Islands. (a) Approximate Tracks of the Typhoons of October, 1909; (b) Typhoon of Oct. 17 and 18. Rainfall (mm.) in 24 hours. Accompanied by charts and diagrams of Isobars and Barographic Records. [Illustrate descriptions of these typhoons in *Bull.* for Oct., 1909, Weather Bureau, Manila Central Observatory, Manila, 1910.]

Philippine Islands. Earthquake Map of the Philippines, 1862-1909. No scale. Plate II accompanying "Catalogue of Violent and Destructive Earthquakes in the Philippines, etc." Manila Weather Bureau, Manila, 1910. [Shows the areas affected, the principal mountain systems, and soundings in fathoms.]

Samoa. Die Samoa-Insel Savaii. 1:150,000=2.38 miles to an inch. With insets of parts of the coasts on a larger scale. By Dr. K. Wegener. Illustrates "Die Karte von Savaii," in *Pet. Mitt.,* Vol. 56, No. 4, Justus Perthes, Gotha, 1910. [The map is based upon compass bearings taken at various points on the coast with distances according to the chart of the German Hydrographic Office. Contour lines, with hundred meters interval, indicate the nearly regular slope from the central regions to the sea. Nearly the whole island is shown as covered with forest. The plantations, in the coastal region, are indicated and also the locations of the numerous volcanoes.]

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BULLETIN

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THE ANGLO-SAXONS OF THE KENTUCKY MOUNTAINS:*

A STUDY IN ANTHROPOGEOGRAPHY

BY

ELLEN CHURCHILL SEMPLE

In one of the most progressive and productive countries of the world, and in that section of the country which has had its civilization and its wealth longest, we find a large area where the people are still living the frontier life of the backwoods, where the civilization is that of the eighteenth century, where the people speak the English of Shakespeare's time, where the large majority of the inhabitants have never seen a steamboat or a railroad, where money is as scarce as in colonial days, and all trade is barter. It is the great upheaved mass of the Southern Appalachians which, with the conserving power of the mountains, has caused these conditions to survive, carrying a bit of the eighteenth century intact over into this strongly contrasted twentieth century, and presenting an anachronism all the more marked because found in the heart of the bustling, money-making, novelty-loving United States. These conditions are to be found throughout the broad belt of the Southern Appalachians, but nowhere in such purity or covering so large an area as in the mountain region of Kentucky.

A mountain system is usually marked by a central crest, but the

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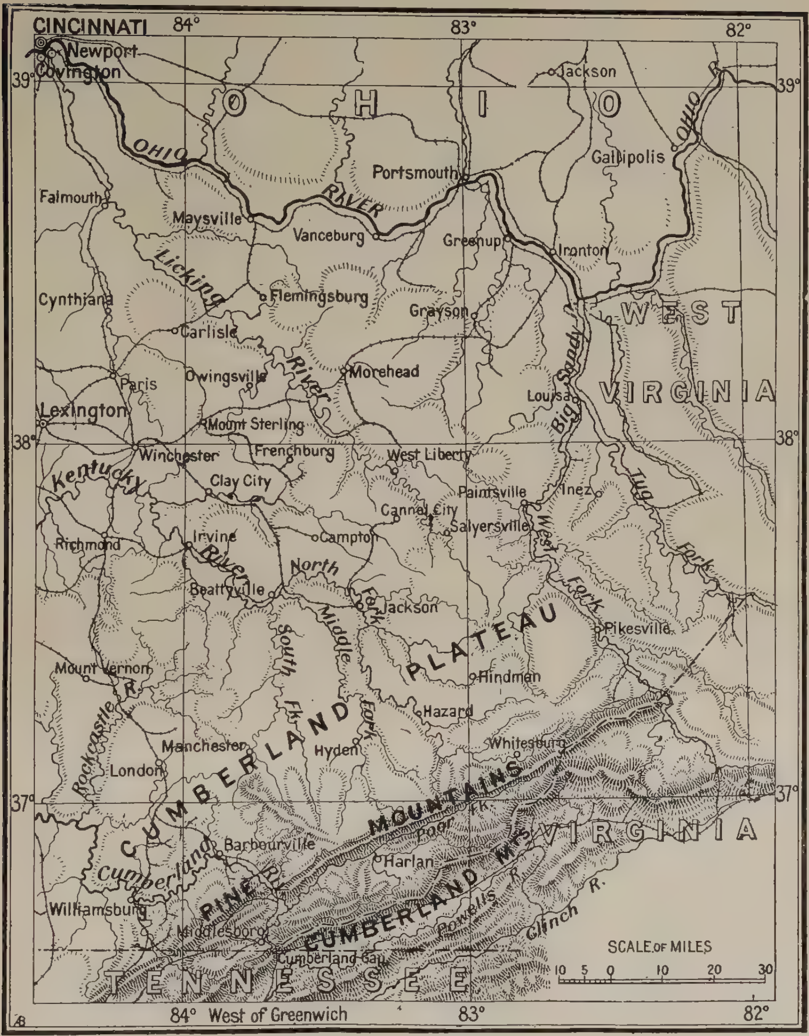
Appalachians are distinguished by a central zone of depression, flanked on the east by the Appalachian Mountains proper, and on the west by the Allegheny and the Cumberland Plateaus. This central trough is generally designated as the Great Appalachian Valley. It is depressed several hundred feet below the highlands on either side, but its surface is relieved by intermittent series of even-crested ridges which rise 1000 feet or more above the general level, running parallel to each other, and conforming at the same time to the structural axis of the whole system. The valleys between them owe neither width nor form to the streams which drain them. The Cumberland Plateau forms the western highland of the Great Valley in Eastern Kentucky, Tennessee, and Northern Alabama. This plateau belt reaches its greatest height in Kentucky, and slopes gradually from this section to the south and west. Its eastern escarpment rises abruptly 800 to 1500 feet from the Great Valley, and shows everywhere an almost perfectly straight skyline. The western escarpment is very irregular, for the streams, flowing westward from the plateau, have carved out their valleys far back into the elevated district, leaving narrow spurs running out into the low plains beyond. The surface is highly dissected, presenting a maze of gorge-like valleys separating the steep, regular slopes of the sharp or rounded hills. The level of the originally upheaved mass of the plateau is now represented by the altitude of the existing summits, which show a remarkable uniformity in the northeast-southwest line, and a slight rise in elevation from the western margin towards the interior.

About 10,000 square miles of the Cumberland Plateau fall within the confines of the State of Kentucky, and form the eastern section of the State. A glance at the topographical map of the region shows the country to be devoted by nature to isolation and poverty. The eastern rim of the plateau is formed by Pine Mountain, which raises its solid wall with level top in silhouette against the sky, and shows only one water-gap in a distance of 150 miles. And just beyond is the twin range of the Cumberland. Hence no railroads have attempted to cross this double border-barrier, except at the northeast and southeast corners of the State, where the Big Sandy and Cumberland Rivers have carved their way through mountains to the west. Railroads, therefore, skirt this upland region, but nowhere penetrate it. The whole area is a coalfield, the mineral being chiefly bituminous, with several thousand square miles of superior cannel coal. The obstructions growing out of the topography of the country, and the cheap river transportations afforded by the Ohio for the Kanawha



EASTERN PART OF KENTUCKY.

Note the very small development of railroads.

and Monongahela River coal have tended to retard the construction of railroads within the mountains, and even those on the margin of this upland region have been built since 1880.

Man has done so little to render this district accessible because nature has done so little. There are here no large streams penetrating the heart of the mountains, as in Tennessee, where the Tennessee River, drawing its tributaries from the easternmost ranges of the

Appalachians, cuts westward by flaring water-gaps through chain after chain and opens a highway from the interior of the system to the plains of the Mississippi. The Kentucky streams are navigable only to the margin of the plateau, and therefore leave this great area without natural means of communication with the outside world to the west, while to the east the mountain wall has acted as an effective barrier to communication with the Atlantic seaboard. Consequently, all commerce has been kept at arms' length, and the lack of a market has occasioned the poverty of the people, which, in turn, has prohibited the construction of highroads over the mountains of the Cumberland Plateau.

It is what the mountaineers themselves call a rough country. The steep hills rise from 700 to 1200 feet above their valleys. The valleys are nothing more than gorges. Level land there is none, and roads there are almost none. Valley and road and mountain stream coincide. In the summer the dry or half-dry beds of the streams serve as highways; and in the winter, when the torrents are pouring a full tide down the hollows, foot trails cut through the dense forest that mantles the slopes are the only means of communication. Then intercourse is practically cut off. Even in the best season transportation is in the main limited to what a horse can carry on its back beside its rider. In a trip of 350 miles through the mountains, we met only one wheel vehicle and a few trucks for hauling railroad ties, which were being gotten out of the forests. Our own camp waggons, though carrying only light loads, had to double their teams in climbing the ridges. All that had been done in most cases to make a road over a mountain was to clear an avenue through the dense growth of timber, so that it proved, as a rule, to be just short of impassable. For this reason the public of the mountains prefer to keep to the valleys with their streams, to which they have given many expressive and picturesque names, while the knobs and mountains are rarely honored with a name. We have Cutshin Creek, Hell-fer-Sartain, Bullskin Creek, Poor Fork, Stinking, Greasy, and Quicksand Creek. One trail leads from the waters of Kingdom-Come down Lost Creek and Troublesome, across the Upper Devil and Lower Devil to Hell Creek. *Facilis descensus Averno,* only no progress is easy in these mountains. The creek, therefore, points the highway, and is used to designate geographical locations. When we would inquire our way to a certain point, the answer was, "Go ahead to the fork of the creek, and turn up the left branch," not the fork of the road and the path to the left. A woman at whose cabin we lunched one day said,

"My man and me has been living here on Quicksand only ten years. I was born up on Troublesome."

All passenger travel is on horseback. The important part which the horse plays, therefore, in the economy of the mountain family recalls pioneer days. Almost every cabin has its blacksmith's forge under an open shed or in a low outhouse. The country stores at the forks or fords of the creek keep bellows in stock. Every mountaineer is his own blacksmith, and though he works with very simple implements, he knows a few fundamental principles of the art, and does the work well. Men and women are quite at home in the saddle. The men are superb horsemen, sit their animals firm and erect, even when mounted on top of the meal-bag, which is the regular accompaniment of the horseman. We saw one day a family on their way to the country store to exchange their produce. The father, a girl, and a large bag of Indian corn were mounted on one mule, and the mother, a younger girl, and a black lamb suspended in a sack from the saddle-bow on the other. It is no unusual thing to see a woman on horseback, with a child behind her and a baby in her arms, while she holds an umbrella above them.

But such travel is not easy, and hence we find that these Kentucky mountaineers are not only cut off from the outside world, but they are separated from each other. Each is confined to his own locality, and finds his little world within a radius of a few miles from his cabin. There are many men in these mountains who have never seen a town, or even the poor village that constitutes their county-seat. Those who have obtained a glimpse of civilization have gone down the head-waters of the streams on lumber rafts, or have been sent to the State penitentiary at Frankfort for illicit distilling or feud murder. The women, however, cannot enjoy either of these privileges; they are almost as rooted as the trees. We met one woman who, during the twelve years of her married life, had lived only 10 miles across the mountain from her old home, but had never in this time been back home to visit her mother and father. Another back in Perry county told us she had never been farther from home than Hazard, the county-seat, which was only 6 miles distant. Another had never been to the post-office, 4 miles away; and another had never seen the ford of the Rockcastle River, only 2 miles from her home, and marked, moreover, by the country store of the district.

A result of this confinement to one locality is the absence of anything like social life, and the close intermarriage of families inhabiting one district. These two phenomena appear side by side here as

in the upland valleys of Switzerland and other mountain countries where communication is difficult. One can travel for 40 miles along one of the head streams of the Kentucky River and find the same names recurring in all the cabins along both its shores. One woman in Perry County told us she was related to everybody up and down the North Fork of the Kentucky and along its tributary creeks. In Breathitt County, an old judge, whose family had been among the early settlers on Troublesome, stated that in the district school near by there were ninety-six children, of whom all but five were related to himself or his wife. This extensive intermarriage stimulates the clan instinct and contributes to the strength of the feuds which rage here from time to time.

It is a law of biology that an isolating environment operates for the preservation of a type by excluding all intermixture which would obliterate distinguishing characteristics. In these isolated communities, therefore, we find the purest Anglo-Saxon stock in all the United States. They are the direct descendants of the early Virginia and North Carolina immigrants, and bear about them in their speech and ideas the marks of their ancestry as plainly as if they had disembarked from their eighteenth-century vessel but yesterday. The stock is chiefly English and Scotch-Irish, which is largely Teutonic in origin. There is scarcely a trace of foreign admixture. Occasionally one comes across a French name, which points to a strain of Huguenot blood from over the mountains in North Carolina; or names of the Germans who came down the pioneer thoroughfare of the Great Appalachian Valley from the Pennsylvania Dutch settlements generations ago. But the stock has been kept free from the tide of foreign immigrants which has been pouring in recent years into the States. In the border counties of the district where the railroads run, and where English capital has bought up the mines in the vicinity, the last census shows a few foreign-born, but these are chiefly Italian laborers working on the road-bed, or British capitalists and employees. Four of the interior counties have not a single foreign-born, and eight others have only two or three.

Though these mountain people are the exponents of a retarded civilization, and show the degenerate symptoms of an arrested development, their stock is as good as any in the country. They formed a part of the same tide of pioneers which crossed the mountains to people the young States to the southwest, but they chanced to turn aside from the main stream, and ever since have stagnated in these mountain hollows. For example, over a hundred years ago eleven

Combs brothers, related to General Combs of the Revolutionary army, came over the mountains from North Carolina. Nine of them settled along the North Fork of the Kentucky River in the mountains of Perry County, one went further down the stream into the rough hill country of Breathitt County, and the eleventh continued on his way till he came into the smiling regions of the Bluegrass, and there became the progenitor of a family which represents the blue blood of the state, with all the aristocratic instincts of the old South; while their cousins in the mountain go barefoot, herd in one-room cabins, and are ignorant of many of the fundamental decencies of life.

If the mountains have kept out foreign elements, still more effectually have they excluded the negroes. This region is as free from them as northern Vermont. There is no place for the negro in the mountain economy, and never has been. In the days of slavery this fact had momentous results. The mountains did not offer conditions for plantation cultivation, the only system of agriculture in which slaves could be profitably employed. The absence of these conditions and of the capital wherewith to purchase negroes made the whole Appalachian region a non-slave-holding section. Hence, when the rupture came between the North and South, this mountain region declared for the Union, and thus raised a barrier of disaffection through the center of the Southern States. It had no sympathy with the industrial system of the South; it shared the democratic spirit characteristic of all mountain people, and likewise their conservatism, which holds to the established order. Having, therefore, no intimate knowledge of the negro, our Kentucky mountaineers do not show the deep-seated prejudice to the social equality of blacks and whites which characterizes all other Kentuckians. Till abolished by law four years ago, there existed on the western margin of the Cumberland Plateau, a flourishing college for the co-education of the Bluegrass blacks and mountain whites; and this is probably the only geographical location south of the Mason and Dixon line where such an institution could exist.

Though the mountaineer comes of such vigorous stock as the Anglo-Saxons, he has retained little of the ruddy, vigorous appearance of his forebears. The men are tall and lank, though sinewy, with thin bony faces, sallow skins, and dull hair. They hold themselves in a loose-jointed way; their shoulders droop in walking and sitting. Their faces are immobile, often inscrutable, but never stupid; for one is sure that under this calm exterior the mountaineer is doing a deal of thinking, which he does not see fit to share with

the "furriner," as he calls every one coming from the outside world. The faces of the women are always delicately moulded and refined, with an expression of dumb patience telling of the heavy burden which life has laid upon them. They are absolutely simple, natural, and their child-like unconsciousness of self points to their long residence away from the gaze of the world. Their manners are gentle, gracious, and unembarrassed, so that in talking with them one forgets their bare feet, ragged clothes, and crass ignorance, and in his heart bows anew to the inextinguishable excellence of the Anglo-Saxon race.

The lot of a mountain woman is a hard one. Only the lowest peasantry of Europe can show anything to parallel it. She marries between twelve and fifteen years a husband who is between seventeen and twenty. The motive in marriage is very elemental, betrays little of the romantic spirit. Husband and wife speak of each other as "my man" and "my woman." A girl when she is twenty is put on the "cull list," that is, she is no longer marriageable. A man is included in this undesirable category at twenty-eight; after that he can gĕt no one to take him "except some poor wider-woman," as one mountain matron expressed it, adding, "gals on the cull-list spend their time jes' bummin' around among their folks." During a ride of 350 miles, with visits at a great many cabins, we met only one old maid; her lot was a sorry one, living now with a relative, now with a friend, earning her board by helping to nurse the sick or making herself useful in what way she could. The mountain system of economy does not take into account the unmarried woman, so she plunges into matrimony with the instinct of self-preservation. Then come children; and the mountain families conform to the standard of the patriarchs. A family of from ten to fifteen offspring is no rarity, and this characterizes not only the mountains of Kentucky, but the whole area of the Appalachian system. In addition to much child-bearing, all the work of the pioneer home, the spinning and weaving, knitting of stockings, sometimes even the making of shoes and moccasins, falls on the woman. More than this, she feeds and milks the cow, searches for it when it has wandered away "in the range" or forest, hoes weeds in the corn, helps in the ploughing, carries water from the spring, saws wood and lays "stake and ridered" fences. A mountain woman who had a husband and two sons, and who had been employed all day in making a fence, lifting the heavy rails above the height of her own head, replied in a listless way to the question as to what the men

did, with, "the men folks they mostly sets on a fence and chaw tobacco and talk politics."

The mountain woman, therefore, at twenty-five looks forty, and at forty looks twenty years older than her husband. But none of the race are stalwart and healthy. The lack of vigour in the men is due chiefly to the inordinate use of moonshine whiskey, which contains 20 per cent. more alcohol than the standard liquor. They begin drinking as mere boys. We saw several youths of seventeen intoxicated, and some women told us boys of fourteen or fifteen drank. Men, women, and children looked underfed, ill nourished. This is due in part to their scanty, unvaried diet, but more perhaps to the vile cooking. The bread is either half-baked soda biscuits eaten hot, or corn-pone with lumps of saleratus through it. The meat is always swimming in grease, and the eggs are always fried. The effect of this shows, in the adults, in their sallow complexions and spare forms; in the children, in pimples, boils, and sores on their hands and faces. This western side of the mountains, moreover, has not an abundant water-supply, the horizontal strata of the rocks reducing the number of springs. Hence all the mountain region of Kentucky, West Virginia, and Tennessee shows a high percentage of diarrhœal diseases, typhoid, and malarial fever.

The home of the mountaineer is primitive in the extreme, a survival of pioneer architecture, and the only type distinctly American. It is the blind or windowless one-room log cabin, with the rough stone chimney on the outside. The logs are sometimes squared with the hatchet, sometimes left in their original form with the bark on; the interstices are chinked in with clay. The roofs are covered with boards nearly an inch thick and 3 feet long, split from the wood by a wedge, and laid on, one lapping over the other like shingles. The chimneys, which are built on the outside of the houses, and project a few feet above the roof, lend a picturesque effect to the whole. They are made of native rock, roughly hewn and cemented with clay; but the very poorest cabins have the low "stick chimney," made of laths daubed with clay. In the broader valleys, where the conditions of life are somewhat better, the double cabin prevails—two cabins side by side, with a roofed space between, which serves as a dining-room during the warmer months of the year. Sometimes, though rarely, there is a porch in front, covered by an extension of the sloping roof. In some of the marginal counties of the mountain region and in the sawmill districts, one sees a few two-story frame dwellings. These are deco-

rated with ornamental trimming of scroll-saw work in wood, oftentimes colored a light blue, along the edges of the gables, and defining the line between the two stories. The regulation balcony over the front door and extending to the roof has a balustrade of the same woodwork in excellent, chaste design, sometimes painted and sometimes in the natural color. These houses, both in their architecture and style of ornamentation, recall the village dwellings in Norway, though not so beautiful or so richly decorated. But the usual home of the mountaineer is the one-room cabin. Near by is the barn, a small square log structure, with the roof projecting from 8 to 10 feet, to afford shelter for the young cattle or serve as a milking-shed. These vividly recall the mountain architecture of some of the Alpine dwellings of Switzerland and Bavaria, especially when, as in a few instances, the roofs are held down by weight-rocks to economize hardware or protect them against the high winds. Very few of them have hay-lofts above, for the reason that only a few favored districts in these mountains produce hay.

The furnishings of the cabins are reduced to the merest necessaries of life, though in the vicinity of the railroads or along the main streams where the valley roads make transportation a simpler problem, a few luxuries like an occasional piece of shop-made furniture and lamp-chimneys have crept in. One cabin which we visited near the foot of Pine Mountain, though of the better sort, may be taken as typical. Almost everything it contained was home-made, and only one iron-bound bucket showed the use of hardware. Both rooms contained two double beds. These were made of plain white wood, and were roped across from side through auger-holes to support the mattresses. The lower one of these was stuffed with corn-shucks, the upper one with feathers from the geese raised by the housewife. The sheets, blankets, and counterpanes had all been woven by her, as also the linsey-woolsey from which her own and her children's clothes were made. Gourds, hung on the walls, served as receptacles for salt, soda and other kitchen supplies. The meal-barrel was a section of log, hollowed out with great nicety till the wood was not more than an inch thick. The flour-barrel was a large firkin, the parts held in place by hoops, fastened by an arrow-head at one end of the withe slipped into a slit in the other; the churn was made in the same way, and in neither was there nail or screw. The washtub was a trough hollowed out of a log. A large basket was woven of hickory slips by the mountaineer himself, and two smaller ones made of the cane of the broom corn and bound at

the edges with coloured calico, were the handiwork of his wife. Only the iron stove with its few utensils, and some table knives, testified to any connection with the outside world. The old flint-lock gun and powder-horn hanging from a rafter gave the finishing touch of local colour to this typical pioneer home. Daniel Boone's first cabin in the Kentucky wilderness could not have been more primitive.

Some or most of these features can be found in all mountain homes. Some cabins are still provided with hand-mills for grinding their corn when the water-mills cease to run in a dry summer. Clay lamps of classic design, in which grease is burned with a floating wick, are still to be met with; and the manufactured product from the country store is guiltless of chimney. Every cabin has its spinning-wheel, and the end of the "shed-room" is usually occupied by a hand-loom. Only in rare cases is there any effort to beautify these mountain homes. Paper flowers, made from old newspaper, a wood-cut from some periodical, and a gaudy advertisement distributed by an itinerant vendor of patent medicines, make up the interior decoration of a cabin. Sometimes the walls are entirely papered with newspapers, which are more eagerly sought for this purpose than for their literary contents. Material for exterior decoration is more accessible to the mountain housewife, and hence we find, where her work-burdened life will permit, that she has done all she can for her front yard. Poppies, phlox, hollyhock, altheas, and dahlias lift their many-coloured blooms above the rail fence. Over the porch, where there is one, climb morning-glory, sweet potato vines, and wild mountain ivy; and from the edge of the roof are suspended home-made hanging baskets, contrived from old tin cans, buckets, or anything that will hold soil, and filled with the various ferns and creepers which the forests furnish in great beauty and abundance.

A vegetable garden is always to be found at the side or rear of the cabin. This is never large, even for a big family. It is ploughed in the spring by the man of the household, and enriched by manure from the barn, being the only part of the whole farm to receive any fertilizer. Any subsequent ploughing and all weeding and cultivation of the vegetables is done by the women. The average mountain garden will yield potatoes, beets, cabbages, onions, pumpkins, and tomatoes of dwarf size. Beans are raised in considerable quantities and dried for winter use. The provisions for the luxuries of life are few. Adjoining every garden is a small patch of tobacco, which is raised only for home consumption. It is consumed, moreover, by

both sexes, old and young, and particularly by the woman, who both smoke and "dip" snuff, making the brush for the dipping from the twig of the althea. In a large gathering like a funeral, one can often see girls from twelve to fourteen years old smoking their clay or corn-cob pipes. A young woman who went through the mountains last summer to study the conditions for a social settlement there, found the children at a district school amusing themselves by trying to see who could spit tobacco-juice nearest a certain mark on the school-house wall, the teacher standing by and watching the proceeding with interest.

Sugar is never seen in this district, but backwoods substitutes for it abound. Almost every cabin has its beehives, and anywhere from ten to twenty. The hives are made from hollowed-out sections of the bee-gum tree, covered with a square board, which is kept in place by a large stone. The bees feed in the early spring on the blossoms of the yellow poplar, but in the western counties, where this tree is rapidly being cut out of the forest for lumber, honey is no longer so abundant. But the mountain region, as a whole produces large amounts of honey and wax. Pike County, on the Virginia border, produced over 60,000 lbs. of honey in 1890. Maple sugar is gotten in considerable quantities from the sugar maple, which abounds. As one rides through the forests, he sees here and there the rough little log troughs at the base of these trees, the bit of cane run into the hole bored through the bark for the sap, and at long intervals a log sugar-house with its huge cauldron for reducing the syrup. Maple sugar is used only as a sweetmeat. The mountaineer put his main reliance for sweetening on sorghum molasses, which he makes from the sorghum cane. Two acres of this will provide an average mountain household with sorghum molasses, or "long sweetening," for a year. They eat it with their "pone" bread and beans; coffee thus sweetened they drink with relish, though to the palate of the uninitiated it is a dose. Sugar, or "short sweetening," is a rarity.

Conditions point to agriculture as the only means for the Kentucky mountaineer to gain a livelihood. Mineral wealth exists in abundance in this section, but the lack of transportation facilities prevents its exploitation; so the rough hillsides must be converted into field and pasture. The mountaineer holds his land in fee simple, or by squatter claim. This is based, not upon title, but merely on the right of possession, which is regarded, moreover, as a thoroughly valid tenure in a country which still preserves its frontier character. Large

tracts of Kentucky mountain lands are owned by persons outside the state, by purchase or inheritance of original pioneer patents, and these are waiting for the railroads to come into the country, when they hope to realize on the timber and mines. In the mean time the mountaineers have been squatting on the territory for years, clearing the forests, selling the timber, and this with conscious impunity, for interference with them is dangerous in the extreme. Every lawyer from the outside world who comes up here to a county courthouse to examine titles to the land about, keeps his mission as secret as possible, and having accomplished it, leaves the town immediately. If further investigation is necessary, he does not find it safe to return himself, but sends a substitute who will not be recognized.

The pioneer character of the region is still evident in the size of the land-holdings. In the most mountainous parts near the eastern border-line the farms average from 160 to 320 acres; in the western part of the plateau, from 100 to 160 acres. Of the whole state, the mountain counties show by far the largest proportion of farms of 1000 acres and over. Pike County has sixty-six such. Mountaineers in two different sections told us that the land on the small side creeks was better, and there farms averaged about 200 acres; but that on main streams, like the North Fork of the Kentucky River and Poor Fork of the Cumberland, the farms were usually 600 acres, because the soil was poorer. The cause for this was not apparent, unless it was due to exhaustion of soil from long tilling, as the valleys of the main streams, being more accessible, were probably the earliest settled.

Only from thirteen to thirty per cent. of the acreage of the farms is improved; the rest is in forest or pasture. Land is cleared for cultivation in the old Indian method by "girdling" or "deadening" the trees, and the first crop is planted amidst the still standing skeletons of ancient giants of the forests. Indian corn is the chief crop raised, and furnished the main food-supply for man and beast. Great fields of it cover the steep mountain sides to the very top, except where a farmer, less energetic or more intelligent than his fellows, has left a crown of timber on the summit to diminish the evil of washing. The soil on the slopes is thin, and in the narrow V-shaped valleys there is almost no opportunity for the accumulation of alluvial soil. Hence the yield of corn is only from ten to twelve bushels to an acre, only one-third that in the rich Bluegrass lands of Central Kentucky. But population is so sparse that the harvest generally averages forty bushels *per capita*. In the "up-

right" farms all ploughing is done horizontally around the face of the mountain, but even then the damage from washing is very great, especially as the staple crop forms no network of roots to hold the soil and requires repeated ploughing. In consequence, after two successive crops of corn the hillside is often quite denuded, the soil having been washed away from the underlying rocks. The field then reverts to a state of nature, growing up in weeds and briars, and furnishing a scanty pasturage for cattle. Level land is very scarce, and is to be found only in the long serpentines of the main streams; but even here, from long cultivation and lack of fertilizers, a field is exhausted by two crops, and has to "rest" every third year. Clover is almost never seen. The mountaineers maintain it will not grow here, although on our circuit we did see two fields.

Of other cereals beside corn the yield is very small. Some oats are raised; but rye, wheat, barley, and buckwheat are only occasionally found. One or two rows of broom-corn provide each cabin with its material for brooms. Sometimes a small quantity of hay, poor in quality, is cut from a fallow-field for winter use. The yield in all the crops is small, because the method of agriculture employed is essentially extensive. The labour applied is small, limited to what is possible for a man and his family, generally, too, the feminine part of it, because his sons found their own families at an early age. It is almost impossible to hire extra labourers, because this element of the population, small at best, finds more profitable and steadier employment in various forms of lumber industry. The agricultural implements used are few, and in general very simple, except in the vicinity of the railroad. In remote districts the "bull-tongue" plough is in vogue. This primitive implement is hardly more than a sharpened stick with a metal rim; but as the foot is very narrow, it slips between the numerous rocks in the soil, and is therefore adapted to the conditions. Natives in two different sections told us that "folks fur back in the mountains" resort to something still simpler—a plough which is nothing but a fork of a tree, the long arm forming the beam, and the shorter one the foot.

The mountains of Kentucky, like other upland regions, are better adapted to stock farming; but, as the native has not yet learned the wisdom of putting his hillside in grass to prevent washing, and at the same time to provide pasturage, the stock wanders at will in the "range" or forest. There sheep thrive best. They feed on the pea-vine, which grows wild in the dense woods, but will not grow on cultivated land. One native explained that the sheep liked the

"range," because they could take refuge from winter storms and the intense noonday heat of summer in "the stone houses." In answer to the inquiry whether he constructed such houses, he answered with the characteristic reverence of the mountaineer, "No; God made 'em. They're God's houses—just caves or shelter places under ledges of rock." About half of the mountain sheep are Merino and English breeds, but they have deteriorated under the rough conditions obtaining there. While the average yield per fleece for the whole state of Kentucky is over 4 lbs. of wool, for the mountain counties it is only 2 lbs., and in some localities drops to 1⅓ lb. These sheep are naturally a hardy stock, and are often bought up by farmers from the lowlands, taken down to the Bluegrass and fattened for a few months, and sold at a profit.

Sheep are the only product of the mountain farm that can find their way to an outside market and do not suffer from the prevailing lack of means of transportation. In regard to everything else, the effort of the native farmer is paralyzed by the want of a market. If he fattens his hogs with his superfluous corn, they are unfit to carry their own weight over the 40 or 50 miles of rough roads to the nearest railroad, or they arrive in an emaciated condition. So he contents himself with his "razor-back" pigs, which climb the hills with the activity of goats and feed with the turkeys on the abundant mast in the forests. Cattle also are raised only for home use. Steers are used pretty generally for ploughing, and especially for hauling logs. Every cabin has one cow, occasionally more. These can be seen anywhere browsing along the edge of the road, where the clearing has encouraged the grass. In the late summer they feed greedily on "crap grass," or Japan clover (*Lespedeza striata*), which springs up wherever there is a patch of sunlight in the forest. Knowing that dairy products are natural staples in almost all mountain countries of the world, as we penetrated into this district we made constant inquiries in regard to cheese, but everywhere found it conspicuous by its absence. However, on our returning to civilization, the census reports on mountain industries revealed the surprising fact that just one county, in the southwestern part of the district and on the railroad, was cheese-producing, and that it made 6374 lbs. in 1889. The mystery was explained on referring to the statistics of population, which showed that this county harboured a Swiss colony of 600 souls. In the state of West Virginia, also, where the topography of the country is a repetition of that of eastern Kentucky, no cheese is produced; but, on the other hand, considerable quantities are made

in all the mountain counties of Tennessee and Virginia. These states, again, are alike in having, as their geographical structure, the broader inter-montane valleys between the chain-like linear ranges of the Great Appalachian depression. In 1889, Lee County, Virginia, produced 8595 lbs. of cheese; while just over Cumberland Mountain, which forms its western border, Bell County, Kentucky, produced not an ounce.

In spite of the hard conditions of life, the Kentucky mountaineer is attached to this rough country of his. Comparatively few emigrate, and many of them come back, either from love of the mountains or because the seclusion of their previous environment has unfitted them to cope with the rush and enterprise of life in the lowlands. One mountaineer told us that, though it was a poor country, "the men mostly stays here." Another who had travelled much through the district in his occupation of selecting white oak timber for a lumber company, estimated that about one man in five emigrated; such generally go to Missouri, Arkansas, and Texas. We met several who had been out West, but the mountains had drawn them back home again. The large majority of the population, therefore, stay in their own valley, or "cove," as they call it, divide up the farm, and live on smaller and smaller estates, while the cornfields creep steadily up the mountains. The population of these twenty-eight counties with their 10,000 square miles area was about 220,000 in 1880, or over twenty to the square mile; that in 1890 was 270,000, showing an increase of 25 per cent. As the ratio in the past decade has risen, there is now a population of 340,000, or thirty-four to the square mile, while for the state at large the ratio is fifty-four. This growth of population is to be attributed almost entirely to natural increase; and as the accessions from the outside are practically limited to the foreign element, only two or three thousand all told, employed in the coal-mines and on the railroads, so large a percentage of increase precludes the possibility of much emigration. Cities there are none, and the villages are few, small, and wretched. This is true also of the county-seats, which in the interior counties average only from 300 to 400 souls; while those of the marginal counties and located on railroads encircling the mountain districts sometimes rise to 1500, but this is rare.

In consequence of his remoteness from a market, the industries of the mountaineer are limited. Nature holds him in a vise here. As we have seen, a few of his sheep may find their way to the railroad, but his hogs are debarred by the mountains from becoming articles

of commerce. The same is true of his corn, which is his only superabundant crop; and this, therefore, by a natural economic law, the mountaineer is led to convert into a form having less bulk and greater value. He makes moonshine whisky, and not all the revenue officers of the country have succeeded in suppressing this industry. At our first camping-place, only 15 miles from the railroad, we were told there were twenty illicit stills within a radius of 5 miles. Two women, moreover, were pointed out to us who carried on the forbidden industry; their husbands had been killed in feuds, so they continued to operate the stills to support their families. Living so far from the arm of the law, the mountaineer assumes with characteristic independence that he has a right to utilize his raw material as he finds expedient. He thinks it laudable to evade the law—an opinion which is shared by his fellows, who are ready to aid and abet him. He therefore sets up his still in some remote gorge, overhung by trees and thickly grown with underbrush, or in some cave whose entrance is effectually screened by boulders or the dense growth of the forest, and makes his moonshine whisky, while he leaves a brother or partner on guard outside to give warning if revenue officers attempt a raid. It is a brave man who will serve as deputy marshal in one of these mountain counties, for raiding a still means a battle, and the mountaineers, like all backwoodsmen, are fine marksmen. In Breathitt County, called "Bloody Breathitt," four deputy marshals have been killed in the past six months. The moonshiner fully understands the penalty for illicit distilling, and if he is caught, he takes his punishment like a philosopher—all the more as there is no opprobrium attached in his community to a term in the penitentiary for this crime. The disgrace falls upon the one who gave testimony against the illicit distiller; and often a mountaineer, if summoned as a witness in such a case, leaves his county till the trial is over, rather than appear for the prosecution. Most of the moonshine is sold within the mountains. The natives, physically depressed by lack of nourishment and by the prevalent diseases of the district, crave stimulants; so the demand for spirits is steady. Not content with the already excessive strength of moonshine whisky, they often add pepper or wood-ashes to make it more fiery. The result is maddened brains when under its influence, and eventually ruined constitutions.

Forests of magnificent timber cover the Kentucky mountains, and supply the only industry which brings any considerable money from the outside world, because the only one which can utilize the small,

rapid streams for transportation. The steep-sided valleys are productive of valuable hardwood timber. Many varieties of oak, walnut, poplar, chestnut, maple, ash, and tulip trees grow to magnificent size. Log-rolling begins in the fall after the Indian corn harvest, and continues through the winter till March. The logs are deposited along the banks of the streams to wait till a "tide" or sudden rise supplies enough water to move them. Sometimes, where a creek or "branch" is too small to carry its prospective burden, the loggers build across it a "splash dam," behind which logs and water accumulate to the requisite point, and then the barrier is knocked loose, when tide and timber go rushing down the channel. On the main streams of the Kentucky, Big Sandy, Licking, and Cumberland, the logs are rafted and floated down to the saw-mills in the lowlands. All the headwaters of these rivers are marked out to the traveller through the mountains by the lumber stranded from the last "tide" and strewn along their banks.

Some of the wood within a day's hauling of the railway is worked up in a form ready for commerce, but generally with great waste of good material. The fine chestnut oaks are cut down in large quantities simply to peel off tan-bark, while the lumber is left to rot. Railroad ties are cut and shaped in the mountains from the oak and hauled to the railroad. The making of staves of white oak for whisky-barrels is also a considerable industry. The trees are sawed across the length of the stave, and split by wedges into billets, which are then hollowed out and trimmed into shape. This last process is performed by an implement run sometimes by steam, generally by horse-power, for in the latter form it is more readily transported over the rough mountain roads from place to place, as the supply of white oak is exhausted. These staves bring $32.00 a thousand delivered at the railroad. The mountain labourer working at stave-making or at the portable saw-mills earns 75 cents a day, while the usual wages for farm hands in this district are only 50 cents.

The trades in the mountains are the primitive ones of a pioneer community—cobbler, blacksmith, and miller; but even these elemental industries have not been everywhere differentiated. Many a cabin has its own hand-mill for grinding corn when the water-mill is too remote. Many a native still makes moccasins of calf or raccoon skin for himself and his family to spare the more expensive shoes; and it is a poor sort of mountaineer who cannot and does not shoe his own horses and steers. Here is reproduced the independence of the pioneer home. Spinning and weaving survive as an industry

of the women. In some few localities one can still see the flax in every stage, from the green growth in the field to the finished homespun in 100-yard pieces; or, again, one sees a cotton patch in the garden, a simple primitive gin of home invention for separating the fibre, and understands the origin of the cotton thread in the linsey-woolsey cloth of domestic manufacture which furnishes the dresses for women and children. Cotton and flax spinning, however, have died out greatly during the past few years, since the introduction of cheap cotton goods into the mountain districts. Spinning of woollen yarn for stockings is still universal, with the concomitant arts of carding and dyeing; while the weaving of linsey-woolsey for clothes or blankets is an accomplishment of almost every mountain woman. One native housewife showed us her store of blankets, woven by her mother and herself. They were made in intricate plaids of original design and combination of colour, and the owner told us she worked without a pattern and without counting the threads, trusting to her eye for accuracy. Many of the dyes, too, she made herself from certain trees, though a few she bought at the country store. The home-woven counterpanes are very interesting, because the designs for these have been handed down from generation to generation, and are the same that the Pilgrim Fathers brought over to New England. But the mountain woman puts forth her best taste and greatest energy in making quilts. In travelling through this section one looks out for some expression of the æsthetic feeling as one finds it in the wood-carving of the Alps and Scandinavian mountains, the metal-work of the Caucasus, the Cashmere shawls of the Himalayas, and the beautiful blankets of the Chilcat Indians. Gradually it is borne in upon him that quilt-making amounts to a passion among the women of the Kentucky mountains; that it does not merely answer a physical need, but is a mode of expression for their artistic sense; and there is something pathetic in the thought. They buy the calico for the purpose, and make their patchwork in very intricate designs, apparently getting their hints from their own flower-gardens; at any rate, the colours in certain common garden flowers were reproduced in some quilts we saw, and the effect was daring but artistic. Quilt-making fills the long leisure hours of the winter, and the result shows on the open shelves or cupboard which occupies a corner in every house. Passing a one-room cabin on the headwaters of the Kentucky River, we counted seventeen quilts sunning out on the fence.

The only work of the women which brings money into the

family treasury is searching for ginseng, or "sang-pickin'," as the mountaineer calls it. This root is found now only in the wildest, most inaccessible ravines; but the women go out on their search barefoot amid the thick brush and briars, taking their dogs along to keep off the rattlesnakes. They also gather "yellow root" (*Hydrastis canadensis*), which with the ginseng (*Panax quinquefolium*) they dry and then barter for produce at the nearest store, the former at the rate of 40 cents per pound, the latter at three dollars. Most of the trade in the mountains is barter, for money is as scarce as in genuine pioneer countries, and the people are accordingly unfamiliar with it. A native who came over the mountains from some remote cove to sell eggs to a camping party this past summer, was offered a dollar bill for his produce, but refused to accept it, as he had never seen one before, his experience having been limited to silver dollars and small change. At another place we found that the people were reluctant to take the paper currency of the issue of 1892, anything so recent having not yet penetrated into their fastnesses. But the lack of money does not prevent them from being eager traders, especially in horseflesh. One of the attractions of Sunday church-going to the men is the opportunity it offers for this purpose. A glance at one of these little mountain churches when meeting is going on reveals the fitness of the occasion. The people have gathered from every direction for miles around; they have come on their best horses and now every tree on the edge of the clearing has become a hitching-post. Groups form outside before and after the service, satisfying their social craving, and, with the few topics of conversation at their command, talk naturally drifts upon the subject of their "beasties," with the inevitable result of some trading. Their trading propensity carries them so far that they often trade farms as they would horses, no deeds being executed.

As the isolation of his environment has left its stamp upon every phase of the outer life of the mountaineer, so it has laid its impress deep upon his inner nature. The remoteness of their scattered dwellings from each other and from the big world beyond the natural barriers, and the necessary self-reliance of their pioneer-like existence, has bred in them an intense spirit of independence which shows itself in many ways. It shows itself in their calm ignoring of the revenue laws, and in their adherence to the principle of the blood-feud which inculcates the duty of personal vengeance for a wrong. In consequence of this spirit of independence, and of its

antecedent cause in their slight dealings with men, our Kentucky mountaineers have only a semi-developed commercial conscience. They do not appreciate the full moral force of a contract; on this point they have the same vague ideas that many women have, and from the same cause. At all times very restive under orders, when they have taken employment under a superior, their service must be politely requested, not demanded. If offended, they throw up their job in a moment, and go off regardless of their contract and of the inconvenience they may occasion their employer. Every man is accustomed to be his own master, to do his own work in his own way and his own time. And this brings us to another curious characteristic of the mountaineer, also an effect of his isolation. He has little sense of the value of time. If he promises to do a certain thing on a certain date, his conscience is quite satisfied if he does it within three or four days after the appointed time. For instance, some mountaineers had promised to furnish horses for our camping party, which was to start from a certain village on July 15; when that day came half a dozen horses had failed to appear, but their places were supplied and the party moved off. During the succeeding week, delinquent mountaineers dribbled into town with their horses, and were surprised to find they were too late, explaining that they did not think a few days would make any difference.

Living so far from the rush of the world, these highlanders have in their manner the repose of the eternal hills. In the presence of strangers they are quite free from self-consciousness, and never lose their simplicity or directness. There is no veneer about these men; they say exactly what they think, and they think vigorously and shrewdly. Endowed with the keen powers of observation of the woodsman, and cut off from books, they are led to search themselves for the explanation of phenomena or the solution of problems. Though hampered by ignorance, their intellects are natively strong and acute. Conscious of their natural ability, conscious too that they are behind the times, these people are painfully sensitive to criticism. Cut off so long and so completely, they have never been able to compare themselves with others, and now they find comparison odious. They resent the coming of "furriners" among them, on the ground that outsiders come to spy upon them and criticize, and "tell-tale," as they put it, unless they are convinced that it is some commercial mission or a political campaign that brings the stranger. His suspicions allayed, the mountaineer is the most generous host in the world. "Strangers, won't you light and

set? Hitch your beasties. This is a rough country, and I'm a poor man, but you can have all I've got." This is the usual greeting. If it is a question of spending the night, the host and his wife sleep on the floor and give the guests the bed. In a one-room cabin, the entertainment of strangers involves inconvenience, but this discomfort is never considered by the Kentucky highlander. When he says, "You can have everything I've got," this is no lip-service. At one cabin where we spent the night, when we were making our toilettes in the morning, the daughter of the house, with infinite grace and simplicity, offered us the family comb and her own toothbrush. Hospitality can go no further. This quality the Kentucky mountaineer has in common with the inhabitants of all remote, untrodden regions where inns are rare. But if he refuses to be reimbursed for his outlay and trouble, he is repaid in part by the news which the stranger brings, and the guest is expected to be very communicative. He must tell everything he has seen or heard on his journey through the mountains, and must meet a whole volley of questions of a strictly personal nature. Inquiries come as to his age, married or unmarried condition and the wherefore, his health, ailments, symptoms, and remedies.

The mountaineer has a circumscribed horizon of interests; he is little stirred by the great issues of the day, except those of a political nature, and for politics he has a passion. A discussion of party platforms or rival candidates for office will at any time enthrall him, keep him away for a whole day from the spring ploughing or sowing. As we have explained, the mountains presented conditions for agriculture as little adapted for a slave industrial system as did those of New England. Hence, when the conflict of the systems of the North and of the South came to an issue in the Civil War, the mountain sections of the Southern States took the side of New England, and went over almost bodily into the Republican party. Such was their zeal for the Union, that some of the mountain counties of Kentucky contributed a larger quota of troops, in proportion to their population, for the Federal army than any other counties in the Union. The enthusiasm of those days survives in that section to-day in their staunch adherence to the Republican party. The spirit has been encouraged also by the fact that topography has defined the mountain section as one of the political divisions of the State by a kind of common law of both political parties in their conventions and in common parlance. Although more sparsely populated than any of the others, the mountain division, from its greater

local unity, is relatively much stronger in party conventions, since its delegate vote is more likely to be a unit. In consequence of this fact, it is sure to get a fair proportion of its men as candidates upon the State ticket, and its party vote can be counted upon with considerable accuracy. Knowing, therefore, that they are a strong factor in the politics of the State, it is not surprising that the Kentucky mountaineers should find therein a great interest.

Men who, from the isolation of their environment, receive few impressions, are likely to retain these impressions in indelible outline; time neither modifies nor obliterates them. Thus it is with the Kentucky mountaineer. He never forgets either a slight or a kindness. He is a good lover and a good hater; his emotions are strong, his passions few but irresistible; because his feelings lack a variety of objects on which to expend themselves, they pour their full tide into one or two channels and cut these channels deep. Like all mountain-dwellers, they love their home. They love the established order of things. Their remoteness from the world's great current of new ideas has bred in them an intense conservatism, often amounting to bitter intolerance. For instance, they were so outraged by the divided skirts and cross-saddle riding of some of the women of our party, that in one county they were on the point of blocking our way; in another, they were only dissuaded from a raid on the camp by a plea from a leading man of the town for the two Kentucky women of the party who used side-saddles, and everywhere they gave scowling evidence of disapproval. There were no jeers; the matter was to them too serious for banter or ridicule. Nor was their feeling, as we shall see later, an outgrowth of a particularly high and delicate standard of womanhood; it was more a deep-seated dislike of the unusual. Painfully lax in many questions of morals, they hold tenaciously to matters of form. The women who came into our camp at different times to visit us, in spite of a temperature of 90° Fahr., wore red woollen mitts, their tribute to the conventions.

The upland regions of all countries are the stronghold of religious faiths, because the conservatism there bred holds to the orthodox, while the impressive beauty and grandeur of the natural surroundings appeals to the spiritual in man. Such a religion, however, is likely to be elemental in character—intense as to feeling, tenacious of dogma, but exercising little or no influence on the morals of everyday life. This is the religion of the Kentucky mountaineer. By nature he is reverential. Caves are "God's houses," sun time is

"God's time," indicated by the noon-mark traced with charcoal on the cabin door. A God-fearing man has the unlimited respect of every one in the mountains. A preacher is a privileged person. Wherever he goes he finds free board and lodging for himself and his horse, and his horse is always shod free. In that lawless country, a man who shoots a preacher is ever after an object of aversion, and there is a general assumption that the murderer will not live long—either a superstition or a generalization from the experience that often some individual constitutes himself an arm of the Almighty to punish the offender. One who is a preacher must be "called" to the work, and must serve without pay. The "call" does not presuppose any previous preparation for the profession, and naturally involves some modern substitute for Paul's tent-making to earn a livelihood. The result in the Kentucky mountains is sometimes amazing. Preachers there have been known to be whisky distillers. Some have been seen to take one or two drinks of liquor while delivering a sermon. We attended an outdoor "meetin'" conducted by one whose widowed sister ran a moonshine still. The best are farmers or country storekeepers. All are more or less ignorant, some densely so. We heard one man preach who could neither read nor write. At a meeting of some sectarian association in the fall of 1898, a mountain preacher advanced the opinion that the old blueback spelling-book gave all the education that a preacher needed. The style of preaching that appeals to the mountaineer is purely hortatory. It begins in a natural tone of voice, but, like all highly emotional speech, soon rises to rhythmical cadences, and then settles to a sustained chant for an hour or more. Any explanatory remarks are inserted parenthetically in a natural voice. This, and only this, stirs the religious fervour of the mountaineer. A clergyman from one of our cities who was doing missionary work among these people was met with the criticism after his service, "Stranger, I 'lowed to hear ye preach, and ye jest talked."

Though his religion is emotional and little suggestive of a basis in rationalism, yet the mountaineer takes his mental gymnastics in vigorous discussion of dogma. This seems to be the one form of abstract reasoning open to him—an exercise natural to the Teutonic mind. He is ignorant, remember, therefore positive and prone to distinguish many shades of belief. Sects are numerous. There are four recognized kinds of Baptists in the mountains. Denominational prejudice is so strong that each denomination refuses to have anything to do with another. A Methodist refuses to send

his children to the Presbyterian mission school in his neighborhood, though it is far superior to anything else at his command, and costs him nothing. For this reason the work of the various Home Mission boards in the mountains has achieved only limited results as to number. Only undenominational work, like that of a social settlement, can reach all the people of one locality; and in view of the sparsity of the population, this is a vital matter.

In spite of the intensity of religious feeling, the number of communicants of all denominations forms only from five to fifteen per cent. of the total population. The mountains of Eastern Kentucky show the largest area of this low percentage in the United States, east of the Missouri River and the Indian Territory. It may be due to the lack of churches and of any church organization where the preachers are "called" and do not form a distinct profession. Baptists, Disciples of Christ, and Methodists are most profusely represented. The sparsity of population with the diversity of sects permits religious service only once a month, when the circuit rider comes. This devoted man leaves his farm or store on Friday, and goes "creeter-back" over the mountains to each of his distant charges in turn. The district school building, in lieu of a church, answers for the meeting. Service is held on Saturday morning, and again on Sunday, for many of the congregation have come such a distance they feel entitled to a double feast of religion. They stay at the nearest cabin, which takes them in with their horses. After the Saturday sermon, the secular affairs of the church are attended to, as the mountaineer considers it unseemly to transact any business, even the disciplining of a delinquent member, on Sunday, although outside the sacred precincts he trades horses and indulges his taste for conviviality. Religion is something to be kept assiduously apart from common everyday living.

The fact that the profession of a mountain preacher is only an avocation with its consequent secondary claim upon his time, the fact of the severity of winter weather for horseback travel, and of the impassability of the roads at this season both for pastor and people, render church worship intermittent in this upland region, and at the same time explain the curious custom of the mountain funeral. This never takes place at the time of interment, but is postponed for months or years. It is desirable to have the ceremony at a time when the roads are passable, when the preacher will not be detained by the harvesting of his corn crop, and when there can be a great gathering of kinfolk, for the clan instinct is strong

among these people, and a funeral has its cheerful side in the opportunity of social intercourse it affords. Sometimes a long arrear of funerals has to be observed, if adverse circumstances for several years have prevented a family gathering. At one cabin we visited, the woman of the house told us she was getting ready for a big gathering at her place on the first of October, when the funerals of five of her relatives were to be preached. A university man, travelling through the mountains to make some scientific research, told us he had recently heard a sermon preached in honor of an old man who had died a year before and of a baby girl who had departed this life in 1868. The prominence given to funeral sermons in the season of good roads lends a sombre cast to the religion of the mountaineer, and strengthens in him a fatalistic tendency which is already one of his prominent characteristics, born doubtless of the hopelessness of his struggle with natural conditions. This feeling is so strong that it goes to astonishing lengths. It frankly condemns missions and Sunday schools as gratuitous meddling with the affairs of Providence. An Episcopal bishop recently, on arriving in a mountain village, heard that one of the families there was in great distress, and went immediately to make a visit of condolence. When he inquired as to the cause of their grief, he learned that a ten-year-old son had disappeared the evening before, and they had reason to suppose he had been lost in a large limestone cave which ran back two miles under the mountain not far away. In answer to his question if their search had been fruitless, he learned they had made no attempt at search, but "if he's to die, he's to die" came the wail, with pious ejaculations as to the will of God. In a few moments the man of God was striding along the trail to the cave, a posse of men and boys armed with candles and lanterns pressing close upon his heels, and in two hours the lost child was restored to the bosom of its family.

The morals of the mountain people lend strong evidence for the development theory of ethics. Their moral principles are a direct product of their environment, and are quite divorced from their religion, which is an imported product. The same conditions that have kept the ethnic type pure have kept the social phenomena primitive, with their natural concomitants of primitive ethics and primitive methods of social control. Such conditions have fostered the survival of the blood-feud among the Kentucky mountaineers. As an institution, it can be traced back to the idea of clan responsibility which held among their Anglo-Saxon forefathers; and it is

this Old World spirit which animates them when the eldest man of a family considers it a point of honor to avenge a wrong done to one of his kindred, or when a woman lays upon her sons the sacred obligation of killing the murderer of their father. In a community that grows from within by natural increase, hereditary instincts are strong, and clan traditions hold sway. But if the blood-feud was decadent among the colonial ancestors of our Kentucky mountaineers, the isolation of this wild upland region was all-sufficient to effect its renascence, and to-day in some counties it is a more powerful factor of social control than the courts of law. The mountains, by reason of their inaccessibility and the sparsity of their populations, saw a great prolongation of pioneer days and pioneer organization of society, where every man depended on his own strong arm or rifle to guard his interests and right his wrongs. When the law invaded this remote region, it found the feud established and the individual loath to subordinate himself to the body politic. This individual was justified to himself by the almost universal miscarriage of justice. For the administration of the law is almost impossible in a feud case. It is next to impossible to convict a murderer in his own county, because the jury, and often the witnesses, are intimidated by the party of the defendant, and will fail to render a verdict of guilty; or, if the murder was committed to avenge some real wrong, the mountain jury, trained by tradition in their peculiar ideas of family honor, feels itself in sympathy with the criminal and acquits him. This they do without compunction, for they have as yet only a rudimentary conception of the sacredness of the law. The court often tries a change of venue, but the cost of this is particularly burdensome in a poor community, and the change is made to an adjoining county, where sympathy with mountain methods still holds. As a last resort, a rescue party of the defendant's relatives will make its attempt to defeat justice. An episode of the Howard and Baker feud, which raged during the summer of 1899 in Clay County, was the trial in Knox County of a Baker lad who had killed one of the opposing faction. Forty-two Bakers, armed with rifles and smokeless powder, came over the mountains to attend the trial, and openly established their "fort," or headquarters, in the county-seat. The boy, though clearly guilty, was acquitted, received his gun from the sheriff, and started off that night to the scene of hostilities, attended by his kindred as a guard of honor, not as a rescue party. The consequence is, if a man is killed in a quarrel, his relatives, knowing from long experience the helplessness of

the law, take the matter of punishment into their own hands, and at their first chance shoot the murderer. But the desire for personal vengence is always present. In this same Howard and Baker feud, Tom Baker shot to death William White, an ally of the Howards and brother of the sheriff, as likewise kinsman of the county clerk, jailer, and judge. Naturally reluctant to give himself up to officials who were his personal enemies, Baker took to the hills until State troops were sent to the county, when he gave himself up to them. They pitched tent in the court-house yard, with a Gatling gun in position for action, and Tom Baker was placed in a tent in the centre, while no one was allowed to enter the military lines. But one day his guards brought Tom Baker for a moment to the door of his tent for a breath of air, and in that instant a shot, fired from the house of the sheriff, found its way to his heart. And the mountaineers openly exulted that a hundred trained soldiers could not protect a man who had been marked out as a victim.

The exciting causes of these feuds are manifold and often of a trifling nature. A misunderstanding in a horse trade, a gate left open and trespassing cattle, the shooting of a dog, political rivalry, or a difficulty over a boundary fence may start the trouble. The first shooting is sometimes done in the madness of moonshine intoxication. These mountaineers are men who hold life as light as a laugh, and to such anything is sufficient provocation to shoot; so the first blood is easily shed. The feud once started, a long and bloody war ensues, often for several years, in which waylaying, shooting from ambush, and arson are regular features. Sometimes pitched battles, engaging a hundred men or more, or a protracted siege of a factionist stronghold varies the programme. In the recent Howard and Baker feud, the principals were men of prominence, influence, and means, so they were able to command a number of followers. The main allies of the Howards were the White family, who have furnished members of the United States Congress, State Senate, and House of Representatives, and have controlled the offices of the county for fifty years. In the French and Eversole feud, which raged at intervals for many years in Perry County, the best people of the county were drawn into one or the other faction. And yet throughout this section there are those who deplore the reigning lawlessness.

In all mountain regions of the world crimes against persons are far more frequent than crimes against property. So in the Kentucky uplands the former are frequent, the latter rare. There is no

real disgrace attached to killing an enemy or a government officer who attempts to raid a moonshine still. There is little regard for the law as such, little regard for human life; but property is sacred. If a mountaineer is asked what, in the eyes of the mountain people, is the worst crime a man can commit, the answer comes, "Horse-stealing. If a man up here steals a horse, his best friend would not trust him again with fifty cents." Here speaks the utilitarian basis of his ethics in the almost impassable roads and trails of a pioneer country. To further inquiry he replies, "And the next worst thing is to steal logs out of a stream—indeed, to steal anything." The mountaineer is honest, scrupulously so. If a log from a lumber-camp is stranded on his field from a subsiding flood in the river, he rolls it into the water at the next rise; or if this is impossible on account of its weight, he lets it lie and rot as a matter of course, for it never occurs to him to cut it up for his own use. He never locks his door. If a robbery occurs, the punishment is swift and sure, for the hue-and-cry is raised up and down the valley or cove, and the escape of the culprit is almost impossible. Primitive in their shortcomings, these mountain people are primitive also in their virtues. The survival of the clan instinct has bred in them a high degree of loyalty; and their free, wild life, together with the remoteness of the law, has made them personally brave. They carry themselves with a certain conscious dignity which peremptorily forbids all condescension. Every man recognizes man's equality; there are no different classes. The consequence is the prevalence of that democratic spirit which characterizes the mountains of Switzerland and Norway.

In only one respect do the mountain people show marked moral degradation. There seems to be no higher standard of morality for the women than for the men, and for both it is low. This is true throughout the Southern Appalachians. The women are modest, gentle, and refined in their manners, but their virtue is frail. The idealism of youth generally keeps the girls pure, but when they marry and take up the heavy burdens that mountain life imposes upon them, their existence is sunk in a gross materialism, to which their environment offers no counteracting influence. Furthermore, the one-room cabin harbours old and young, married and single, of both sexes.

The Kentucky mountaineers are shut off from the inspiration to higher living that is found in the world of books. Isolation, poverty, sparsity of population, and impassability of roads make an education

difficult, if not impossible; the effect of these conditions is to be seen in the large percentage of illiterates in this section. Of the women over twenty-five years old and men over forty, 80 per cent. can neither read nor write. It is quite the usual thing to meet men of clear, vigorous intellects and marked capacity in practical affairs who cannot sign their own names. One mountaineer gave it as his observation that only one-half of the men over twenty years in his county could read. With the children it is somewhat better, because with the natural increase of population more district schools are established, and distances are therefore shortened for the tramp from cabin to school-house. To children who must go barefoot, or wear home-made moccasins, or who can afford not more than one pair of store shoes a year, the question of distances is a vital one, especially in the winter. The district schools are in session for five months, from August first till Christmas. The number of pupils at a school ranges from fifty to a hundred of all ages from six years to twenty, and all are in charge of one ignorant, often inexperienced teacher. They start in at their work in August, but it is soon interrupted for a week, because the instructor has to leave to attend the Teachers' Institute at the county-seat. On October first the older boys and girls are withdrawn from school for two weeks to help get in the harvest. Then November comes, and with it in alternative years certain important state and county elections. If the teacher is a man, being one of the few educated men of the section, he is probably a candidate for one of the county offices, or a member of his always numerous family connection aspires to the State legislature. In either event the teacher, with a mountaineer's sense of the importance of politics, closes school for ten days before the election in order to take part in the campaign. The middle of November the little flock reassembles, and the work of education goes on. But soon the fall rains come, and then the cold and snows of December. First the youngest and frailest are kept at home, but the older and sturdier ones continue, all the more eagerly now because they have the undivided attention of their instructor. The day comes, however, when the intense cold, combined with their own sad want of stout shoes and warm clothes, keeps even the most ambitious at home, and the teacher, with a sigh of relief or regret, locks the school-house door two weeks before the term is over. And the children, with no books at home on which to exercise their attainments, lose almost all that they have gained. And that all is little at best.

The district school of the Kentucky mountains is, in general, a rough log-cabin more or less crudely equipped according to the sparsity or density of the surrounding population. Some are entirely without desks, rude, uncomfortable benches of rough mountain manufacture taking their places. We saw no maps, and instead of blackboards, the unplaned planks of the inside of the walls had been stained a dark color for a space of 12 feet. In some of the back districts, where hardware is at a premium, the children are summoned from recess by a big wooden rattle. If the physical equipment of the school is primitive, the mental is almost as crude. The standard of education for the teachers is not high. Some of them have not progressed farther than the multiplication table in arithmetic, and all use ungrammatical English. Their preparation for teaching in general consists of the course of instruction at the district school and a few months' training at the so-called normal school of the county-seat. At a recent meeting of the Teachers' Institute in one of the mountain counties, when the subject up for discussion was "Devotional exercises in schools," it transpired that, of the fifty-six public school teachers present, only one in eight knew the Lord's prayer, a majority did not know what it was or where it came from, a majority did not own a Testament, and only two or three were the proud possessors of a Bible. Such ignorance is pitiable, but pitiable chiefly because it means lack of opportunity. Many of such teachers are half-grown boys and girls, who are in this way trying to earn the money, always so scarce in the mountains, "to go down to the settlements" and get an education. When their desire for knowledge is once aroused, they are strong, persistent, and ready to face any obstacle to get an education. Their vigorous minds, unjaded nerves, and hardened bodies combine to make them victors in the struggle. One boy of fourteen started out from his hillside home with his little bundle of clothes slung over his shoulder and 75 cents in his pocket, and tramped 25 miles over rough mountain trails to Berea, where the nearest school and college were. While taking the course there, he supported himself by regular jobs of various kinds, and maintained an excellent standing in his classes. When a mountain lad comes down to the State University at Lexington, it is a foregone conclusion that he is going to carry off the honors. We find at work in him the same forces that give success to the youth from the Swiss Alps and the glens of the Scotch Highlands, when these too come down into the plains to enter the fierce struggle for existence there. For the Kentucky

lad, the change has meant a stride over an intervening hundred and fifty years.

The life of the Kentucky mountaineer bears the stamp of the eighteenth century. His cabin home is rich in the local color of an age long past. The spinning-wheels for flax and wool, the bulky loom in the shed-room outside, the quaint coverlet on the beds within, the noon-mark on the door, and, more than all, the speech of the people, show how the current of time has swept by and left them in an eddy. The English they speak is that of the Elizabethan age. They say "buss" for kiss, "gorm" for muss, "pack" for carry, and "poke" for a small bag. Strong past tenses and perfect participles, like "holp" and "holpen," and the syllabic plural of words ending in *st,* like "beasties," are constantly heard. The Saxon pronoun "hit" survives not only in the upland regions of Kentucky, but also of the Virginias, Carolinas, and Tennessee. With the conserving power of the mountains has come into operation also their differentiating influence within their boundaries. Every valley has some peculiarity of vocabulary or speech which distinguishes it from the community across the adjoining range. The mountaineers have, therefore, criticized the dialect in John Fox's stories of this region, because they are not judges of the dialect of any locality but their own. A similar region of retarding isolation and of Elizabethan English is found on Hatteras Island, which lies a hundred miles off the North Carolina coast, remote from the usual line of travel. It has preserved a vernacular speech which to-day needs a glossary to be intelligible, but which is fast conforming to the modern standard, since the recent introduction of daily mail boats.

Survivals of speech are accompanied also by survivals of customs. In the mountains, the "rule of the road" when two horsemen or wagons meet is to turn to the left, as in England. Another relic of old Scotch or English custom we find in the "infare" or "infair," after a mountain wedding. This is the dinner given at the home of the groom's parents the day after the ceremony. It was observed in the rural districts of all Kentucky and Indiana up till fifty years ago, but now is adhered to only in the mountains. A more remarkable case of survival was discovered in 1878 by Prof. Nathaniel S. Shaler, of Harvard, on the borders of Virginia and Kentucky. There in a secluded valley he found men hunting squirrels and rabbits with old English short-bows. "These were not the contrivance of boys or of to-day, but were made and strung, and

the arrows hefted in the ancient manner. The men, some of them old, were admirably skilled in their use; they assured me that, like their fathers before them, they had ever used the bow and arrow for small game, reserving the costly ammunition of the rifle for deer and bear."

Though these people came into the mountains with eighteenth-century civilization, their isolation and poverty not only prevented them from progressing, but also forced them to revert to earlier usages which at the time of their coming were obsolescent. This is the explanation of the feud, as has been shown above, of the use of the hand-mill and short-bow, and especially of the old English ballad poetry which constitutes the literature of these mountain folk to-day. This has survived, or, more properly, flourished in its mediæval vigor because it has not felt the competition of books. The scant baggage of the pioneer immigrants from colonial Virginia and Carolina could not allow much space for books, and the few that did make the trip across the Appalachian Mountains were used up, from much reading and handling, by one generation. Poverty and inaccessibility prevented an invasion of new books from without, and from within there was no competition from newspapers. There are to-day twenty contiguous mountain counties, covering altogether an area of 6,000 square miles, not one of which can boast a printing-press. Under these circumstances, the Kentucky mountaineer reverted to his ancestral type of literature and revived ballad poetry. This has now been handed down from lip to lip through generations, the slightly variant form and phrase only testifying to its genuineness. The ballad of "Barbara Allen," popular in Great Britain three hundred years ago, and known now in America only to the musical antiquarian, is a stand-by in several of the mountain counties. The tragic ballad of "Little Sir Hugh," or "The Jewish Lady," as it is variously called, traces back to the Prior's Tale of Chaucer. The lengthy ballad of "Lord Bateman," or "The Turkish Lady," shows unmistakable identity with the poem of the same name in Kurlock's "Ancient Scottish Ballads," though the Scotch version is longer.

Animated by the spirit of minstrelsy, the mountaineers have composed ballads on the analogy of the ancient. These are romantic or heroic and of narrative length. We heard a woman sing a native ballad of fifty-two stanzas, entitled "Beauregard and Zollicoffer," which recounted the deeds of these two generals of the Civil War. The music for all these ballads is in a weird minor key, and is sung

in a nasal tone. So far as we were able to judge, the women are the chief exponents of mountain minstrelsy, and the accuracy of their memories for these long poems is suggestive of Homeric days. Spain and Sicily are perhaps the only other parts of the civilized world, at least in Europe and America, where modern folk-songs are still composed in the form of ballad poetry.

The whole civilization of the Kentucky mountains is eloquent to the anthropogeographer of the influence of physical environment, for nowhere else in modern times has that progressive Anglo-Saxon race been so long and so completely subjected to retarding conditions; and at no other time could the ensuing result present so startling a contrast to the achievement of the same race elsewhere as in this progressive twentieth century.

THE INFLUENCE OF THE PRECIOUS METALS ON AMERICAN EXPLORATION, DISCOVERY, CONQUEST AND POSSESSION*

BY

GEORGE D. HUBBARD, PH.D.†

Early Explorations and Discoveries. Beginning with the first explorer who sailed across the Atlantic, "the expectation of finding a land rich in treasures of gold and silver or in products easily sold for the metals was the prevailing motive in the minds of most of the early discoverers and explorers." Whitney says‡ the sixteenth century travelers had little else in mind save the recompense for their toils and dangers in the rich mines of the precious metals which they were going to discover. Thus exploration was prompted by the desire for gold or for the lucrative trade in gold and spices from the Orient. The news of immensely rich empires, and mines of gold and silver ceaselessly attracted Spanish exploration and conquest into new quarters and thereby the more rapidly and extensively opened up the New World to the knowledge of mankind. The

* This paper is a portion of a thesis presented as a part of the requirements for the Ph.D. degree in Geography at Cornell University. For other parts see *Scottish Geographical Magazine* and later numbers of the *Bulletin*. Special thanks are given to Profes ors R. S. Tarr, W. F. Willcox and H. Ries for criticism and suggestion throughout the whole work.

† Read before the Association of American Geographers, Baltimore, 1908.

‡ Whitney, J. D. Metallic Wealth of the United States, p. xxi.

treasure was first found, in quantities, in the vaults and temples of the Indian civilizations both in Mexico and in Peru; but it was soon also discovered in the mines from which the natives derived it, and in others new even to them.*

Balboa, on the Isthmus in search of precious metals in 1513,† found gold in the hands of natives and traded for 500 pounds of it. Cortez on the Gulf Coast of Mexico learned of the wealth of the kingdom of Montezuma, and marched successfully on his capital, destroying the natives in vast numbers in order to effect his purpose and get possession of the treasure. Pizarro is said to have extorted from the Incas $15,000,000 worth of gold and silver, partly by peaceable means, but with accompanying slaughter and pillage.‡ These discoveries were of prime importance as revealing metals already extracted; and they soon led to the finding of the sources.

The Spaniards wanted gold, silver, or anything which would bring the precious metals easily; and by all methods they acquired about $250,000 per annum, chiefly gold, during the first thirty years (1492-1521). But during the conquests of Mexico and Peru, and for ten years thereafter, the acquisition of precious metals, now largely silver, rose rapidly to about $3,000,000 per annum. So far, essentially all the wealth obtained by the Spaniards in America was gotten by conquest, plunder, tribute or barter. Practically no mining had been done prior to 1546, when the fabulously rich silver mines at Potosi in Bolivia were discovered, together with other mines of both silver and gold. And now, by forced native labor, and negro labor, the production of silver took another quick stride and rose to an average of $10,000,000 per annum until 1600.§

Near the close of the sixteenth century, the Jesuits had spread across Mexico, gotten control of Lower California and discovered the pearl fisheries of the warm adjacent seas. Spanish settlers followed, and these discovered auriferous gravels, the southern end of that long line of gravel deposits extending north and south across the United States and Canada. Settlements grew, and agriculture began. The Indians harassed the settlers until their complaints brought a small army from headquarters, who pursued the Indians into the mountains and in 1771 discovered very rich placers.‖ Some 2,000

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* Patterson, R. H. The New Golden Age. Vol. 1., pp. 422-424.

† *Ibid.*, pp. 339-340.

‡ *Ibid.*, p. 340; also Bancroft, H. H., Mexico, Vol. 3, pp. 571-2; Prescott, W. H., The Conquest of Peru, Vol 1, pp. 433, 467.

§ Patterson, R. H., The New Golden Age, Vol. 1, pp. 422-424.

‖ *Ibid.*, Vol. 1, pp. 347-350.

persons rushed in, within a few months, and the deposits were extensively developed. As in the case of California later, lack of provisions hindered development. It is interesting to note how near these developments led them to California, and how close they came to making discoveries that would have profoundly modified the course of history in the United States in 1846-48, and subsequently.

TWO MOTIVES IMPELLED THE SPANISH. In the course of events connected with the Spanish occupation of America two motives prompted action, motives often operating in the same mind. One was the avowed purpose of the religious orders to promulgate their religion among the natives; the other, the ceaseless attraction exerted by treasure upon the military.* But, unfortunately, the Jesuits were sometimes influenced by the knowledge of the occurrence of silver and gold. While the chief missionary of a party may have had pure motives, his helpers often completely forgot their specific work and went where treasure bade them go. With this double motive, exploration and conquest rapidly disclosed the New World to the Old. It is not our purpose to trace the influence of the missionary spirit in America. As for the other influence, so far as it operated through the Spanish, and aside from the above mentioned results, its sole effects in America were the enriching of a comparatively small number of Spanish adventurers and the gorgeous maintenance of both Church and State. The commonalty suffered from two conditions, both born in part of greed for gold and silver,—a cramped and restricted trade, and the tyranny, despotism and avarice of officials.

EFFECTS OF GREED FOR GOLD AND SILVER. This very greed for the gold was one of the causes that operated to scatter the energy of the Spanish over Southern North America and all South America, and to prevent their developing cities or fixed industries. They conquered, primarily for its treasure, a territory larger than they could master and administer; and as a result, their occupancy was irregular and short lived over a considerable portion of their possessions.† The thirst for gold made the adventurers wild and led them a romantic career in the New World. They disdained agriculture, neglected singularly fertile plains, and thwarted legitimate commerce. They directed their steps wherever they heard tales of abundant treasure. And it was in these pursuits, so eagerly and mercilessly carried on, that they destroyed the native population and thus greatly lessened the value of their possessions by denuding the

* Bourne, E. G., Spain in America, pp. 170–175; Keller, Colonization, pp. 176–8, 203.

† *Ibid.*, p. 201.

land of its native races.* Had this industrious and rudely cultured race of Indians been conserved and properly dealt with, the Spaniards might have had a loyal colony instead of a rebellious vassalage. And, further, the Indians might have lasted some time as tillers of the soil, if given careful and wise supervision, and thus have produced abundant harvests of products desired in Europe, thereby adding extensive and lucrative commerce to Spain's advantage. And what would have been Spain's gain, would also have been England's and America's.

Hypothetical Cases. Whether the absence of the treasure would have made the Spanish even endurable masters or not, is a question; but it is certain that, having once scented it, their avarice knew no bounds, and destruction and bloodshed followed in their wake. Had their course been so different as to have perpetuated their occupation of Mexico as long as they held Cuba, American history would have been quite another story. And with a loyal Spanish colony south of us as successful as the British Colony north of us, our history and development might have been considerably different. What has been said of the Spanish in Mexico applies in principle to the Spanish in Peru and Bolivia. We might have had more valuable neighbors in these countries. What might have been is hard to tell, but it is safe to assert that the conditions assumed above would have yielded results very different from those which have passed into history. Spanish power in America was intimately connected with the output of the precious metals. When the treasure flowed freely, Spain flourished both at home and abroad; and when it slackened, her power withered. Probably without the precious metals, her course would have been less offensive, and her influence less pernicious.

English and Spanish Compared. South American mines were worked three-quarters of a century before there was an English settlement on the American continent. A century of Spanish exploration, gold hunting, christianizing and a kind of colonizing, in the South had been completed before the occupation of the northeastern seaboard began; then followed a century of settlement and exploration along the North Atlantic. While, in individual cases, some exploration and exploitation was done by the English immigrants in the vain hope of finding wealth in gold or silver, as colonists they were actuated by other motives. Not finding gold, they were not scattered through the mountains, but became much more of a solid

* *Ibid.*, p. 271; Patterson, R. H., The New Golden Age, Vol. 1, pp. 337–8.

unit than did the Spanish. Other factors, however, than the absence of gold operated against their becoming scattered. Since Spain had laid claim to so much of the South, the English, when ready to explore and settle, were restricted to the so-called less desirable parts.* Had there been easily gotten mineral wealth discovered in the Appalachian hills and valleys in the early days, there would have been a rush of adventurers at first, with fewer fixed and staid settlements. Perhaps it would have been roving Spanish, and not English, along the Atlantic coast. Hardships under the less settled conditions would greatly have surpassed those of the early colonists as it was, or even those of California in 1849 and 1850. One might well ask, what would our history have been had there been abundance of precious metals in New England and the Old Appalachians. Of course, ultimately the result would have been the development of the country; but its possession undoubtedly would have been different. Again, suppose the Spanish had not found treasure in the South. Well does Whitney† suggest, "How different might have been American history had there been settlements in the Mexican and South American States instead of silver." No doubt the distribution of gold and silver found response in the distribution of the nations in America in the early days. This is never more clearly seen than when the profoundly different distribution is imagined.

THE FRENCH. The French in America are usually thought of as a people with very slight predilections for the precious metals. They were led by other motives. But we are told that they explored extensively for gold and silver in 1719-20, about the junction of the Missouri and the Mississippi rivers, but, of course, with no positive results. Had they found the object of their quest in the region, the story of French exploration, occupation and possession would have needed another chapter.

SUMMARY TO 1848. Thus it becomes apparent that the desire for the precious metals was an active agent in the explorations carried on by the early voyagers; that the distribution of gold and silver led the searchers into nearly all parts of America south of the thirtieth parallel of north latitude, and aided in scattering the energy of the Spanish over too large a territory; that greed and avarice, finding a fertile soil in the acquisition of American precious metals, caused the Spanish to adopt and maintain a policy toward the natives and toward her colonists both cruel and pernicious; a policy, detri-

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* Keller, Colonization, pp. 178-80.

† Whitney, J. D., Metallic Wealth in the United States, p. xxi.

mental to the United States through our relations with Mexico; that the lack of gold and silver in the Appalachians has had an influence for good, especially on the English colonists, and through them on the conquest and possession of the northeastern United States; and that the finding of treasure and the increasing production of gold and silver have stimulated geographic exploration and discovery.

The amount of production of gold and silver continued to rise, and the cost to decline from time to time by the introduction of improved processes. It is stated that the production of gold and silver in the New World in 1800 had risen to about $50,000,000 per annum. It is also known that the production of the United States at that time was scarcely one-third of a million, and mostly gold, per annum; yet, indirectly, the production in other American States has aided the United States and has modified early American history perceptibly.

The California Gold. Up to the discovery of gold in California the Pacific side of the continent had remained almost an uninhabited region save for the scattered Franciscan missionary posts; and unvisited except by a few scientific expeditions that crossed the desert and mountain wastes, by whalers who occasionally touched the coast, and by trappers and fur traders who moved up and down the streams and along the coast. The interior was visited even less. Knowledge concerning the whole region was very meager. The few expeditions brought back a little information concerning strips of country actually crossed, and the trappers and fur traders knew the courses of the streams, but the real opening up of the country and the discovery of its resources, agricultural as well as mineral, had scarcely begun in 1848. Transportation was very difficult, food all but wanting, water restricted to widely scattered points, and Indians were hostile. No advantages to be gained by crossing were known. The greatness of the uninhabited region required almost prohibitive provisioning of expeditions purposing to cross; and the pressure of population from the east had not yet reached a sufficient degree to push the frontier into the deserts and mountains.

But with the discovery of the wealth buried so slightly in the sands of the Sierras, was also found the incentive sufficient to induce men to brave the difficulties presented by a long land journey, or to risk the perilous voyage of six months around Cape Horn to reach the otherwise inaccessible California. Incidental to getting into California, more exploration of the interior was done in one summer than had ever been done before, and more than probably would have

been done in the normal course of events in a score or two of years to come.

The fur traders had worked out many routes, but rarely did they point the way entirely across from the Mississippi to the Pacific. Fremont's report in 1845, embodying careful topographic and descriptive work, was a further contribution to the scanty fund of information concerning routes westward. The Oregon trail* was worked out, and used prior to the gold discoveries by several bands who later, in part, at least, figured in California. Perhaps the Sante Fé trail† from St. Louis to Sante Fé, and the Gila and Spanish trails from there to southern California were as important as any of the older trails. These routes were almost entirely established prior to 1848, hence, their discovery can by no means be ascribed to the influence of this metal; but they were little known and little used save by the fur traders until 1849. During that summer trails became roads, and bridle paths highways, cut-offs were found, new watering-places discovered and in many ways the courses improved. The trail to Salt Lake City through South Pass was used; but, instead of going on northwestward to the Columbia and Oregon, a new trail was worked out down the Humboldt River to Humboldt Sink, then up the back of the Sierras, and down the many ravines on the western face. The route, a well-woven cord nearly to the eastern slope of these mountains, seemed to fray out into many strands leading down the gulches on the western side. The American River, down which Fremont traveled,‡ is fairly typical in the hardships presented. It is astonishing what difficulties men and even women and children will surmount when under the influence of the gold fever.

Mention must also be made of the exploration of routes, mainly by water, which came into use on the advent of California gold, and led from the Atlantic ports to Mexico and Central America and then by stream or on the land across to the Pacific, and thence to California. The route with the shortest land section crossed the Isthmus of Panama, and was found very early both by passengers and freight. Other routes crossed at Tehuantepec, Nicaragua and from Tampico across northern Mexico to Mazatlan and other Pacific ports, all resulting in the exploration of sections of the country, but, neither in occupation nor in possession, any more than the crossing of the

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* Parkman, Francis. The Oregon Trail.

† Semple, E. C. American History and Its Geographical Conditions. Ch X and XI.

‡ Fremont, J. C., Report of the Exploring Expedition to the Rocky Mountains, pp. 230 f.

arid plains and the mountains, resulted at first in their occupation. Routes discovered and developed by emigrants in search of gold at the end of their journey, differ in this respect from those worked out by the ordinary overland emigrant. Only the discouraged or exhausted halt on the former, while the latter soon become enlivened by settlements of those who find places "good enough for them" and turn aside to occupy.

Exploration by Prospectors. This pioneer exploration, discussed above, took place during the early days of the gold excitement in California; but as the richer deposits became exhausted, the prospector set out, impelled by a continuous vision of "nuggets." He pushed back into the interior wilderness, across deserts, over ridges, into glens, gulches, parks, and long stately valleys; he climbed mountains, crossed divides and traced streams from end to end. While his explorations were not scientific, and his results were not recorded, his discoveries were valuable even aside from the treasure they revealed, because definite reports of his discoveries often got into possession of others; and the latter followed him out to make new settlements or to occupy fields which he had only viewed. And even in the absence of positive statement of valuable finds of minerals, lands, forest, or game, the report that so-and-so had been through certain valleys or over certain mountains or had been exploring in a named locality or direction, served to turn the attention thitherward, and make one feel somewhat acquainted with the places beyond his more complete knowledge. It all aided in the conquest of valley and hillside, spring and water course, to other purposes than the maintenance of wild animals and savages. Desire to find gold, and the reports of gold and silver found all over the West, prompted further exploration, and led to discoveries, not only of precious metals, but of many geographic features, streams, mountains, valleys, and plains, and of many other less attractive but more remunerative resources of the region. Under the powerful stimulus, exploration was very active, and the knowledge of the West extended phenomenally.

Scientific Exploration of Alaska. Nor should this section be concluded without reference to the influence Alaskan gold has had upon exploration. It played no part in the discovery, nor in our gaining possession of the peninsula, but since the announcement of its presence the exploration of the country by prospectors and miners, and by those who would enter the carrying trade to assist the miners, has been very vigorously pushed. In a much closer way careful

surveying and mapping have gone on rapidly under the supervision of the United States Geological Survey, and at the expense of the Federal Government. Of course, this work is not done alone in response to the influence of gold and silver; but the distribution of the work both in Alaska and in the States shows how influential have been the mineral deposits in determining the areas to be surveyed first. Gold and silver have played an important part, as have other minerals.

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TURNING KERGUELEN ISLAND TO ACCOUNT

The perseverance and energy of two brothers, René E. and Henri Bossière,* are at last calling attention to Kerguelen Island as a land that may possibly be developed and settled. This island, in the southern part of the Indian Ocean (49° S.; 70° E.), about midway between Australia and Africa, has not been regarded as offering inducements to enterprise. About 300 islands form the group, most of then very small, or mere rocks, but Kerguelen is said to have an area of over 1,200,000 acres, much of it covered with mountains, but with numerous valleys, abundantly watered and covered with grasses in summer.

This view of the island is quite recent. In fact one of the latest gazetteers speaks of Kerguelen as "sterile or covered with moss." In 1890, the under-Secretary of State for the French Colonies published a work entitled "Les Colonies Françaises," in which it was said that it was not absolutely impossible to settle in Kerguelen, but the island was so far from all maritime routes that it had no interest for colonists. It was discovered in 1772 by the French mariner Kerguelen, who did not land, but hurried back to France to report that he had seen the great southern continent. When France found, two years later, that the continent was merely a small archipelago, without a tree, Kerguelen was thrown into prison, where he spent four

* The enterprise of the Bossière brothers is described in *La Géographie* (July, 1909), *Bull.* Soc. de Géog. Comm. de Paris (January, 1910), *Bull.* de la Soc. de Géog. de Lille (March, 1910), and *Bull.* de la Soc. de Géog. Comm. de Bordeaux (June, 1910).

years. Captain Cook visited Kerguelen, a few years later, and the name he gave to the island, the Land of Desolation, has often been applied to it to this day. The island was also visited by the British explorer Ross, and various scientific expeditions, including the Gauss Antarctic party. Kerguelen, deeply cut by many inlets, is now very well mapped.

The French Government paid no attention to its remote possession; and even French maps printed British names of bays and capes, though French nomenclature has been applied to these features by the earlier explorers. The name of Kerguelen was unknown to most persons when René Bossière made the island the subject of his first pamphlet. His brother and he had never visited Kerguelen, but they had spent the years of 1881 and 1883 in southern Patagonia and were surprised to find the conditions there so favorable for the development of sheep raising. Several millions of sheep are now grazing on the pasturage of that south land and the neighboring plains of northern Tierra del Fuego, which, a generation ago, it was thought could never be turned to good account.

One day the brothers read a geographical account of Kerguelen and were impressed with the reported similarity between the climatic conditions of that island and southern Patagonia. They then made a study of the scanty literature on Kerguelen and it seemed to them that here was a French possession which might be turned to some usefulness. The more they thought of it, the more the idea absorbed them. The French newspapers gave space to their communications, their pamphlets were widely distributed and France began to hear the name of Kerguelen. The brothers at last asked the French Government what financial aid it would accord them if they should occupy the island in its name. The reply was that the Government could give no financial aid, but the enterprise would have its recognition and moral support. They would have to carry on the work at their own risk and cost. On these conditions, a decree was issued in 1893, conceding to the Bossière brothers the exploitation of Kerguelen Island and all the accruing profit for a term of fifty years.

The elder brother is a ship-owner, and his father was the last Frenchman engaged in the whaling industry, which has not attracted any French capital since 1863. The brothers believed, from all they heard, not only that sheep-growing might be made profitable in Kerguelen, but also that whaling and sealing in the neighboring waters would add greatly to the prospects of their enterprise.

Having obtained their concession, Mr. René Bossière went to

Patagonia to make a thorough study of the methods of sheep-farming there, while his brother finally enlisted the interest of a number of French capitalists who, in 1900, agreed to give the enterprise financial support to the amount of $150,000. The services of Captain de Gerlache, the well-known Belgian Antarctic explorer, were secured to lead the first expedition to Kerguelen, and he set out with two small vessels expecting to pick up René Bossière at Magellan Strait. That gentleman waited at the Strait for three months, only to learn, at last, that de Gerlache had put back to France, having decided that he had started too late in the season and, further, that his coal supply was too small for the voyage to the island. The French backers of the enterprise were so discouraged by this outcome of their efforts that they withdrew their support.

The up-hill work that followed need not be detailed here. Nothing but the enthusiasm and indomitable persistence of the two brothers won the day at last. More pamphlets were issued. Special emphasis was placed upon the strong probability that good whaling grounds would be found in the waters around Kerguelen. The Norwegians finally became interested. Money was at last secured to fit out two small French whalers and the Norwegians sent the steamer Jeanne d'Arc, of 2,000 tons.

Thus far, the island has been reached twice by the Bossière vessels—in the southern summers of 1908 and 1909. They report Kerguelen, at that season, as glorious to look upon with its snow-crowned mountains towering above valleys deeply carpeted with nutritious grasses supplying the finest of grazing for the livestock that was landed.

Both these expeditions have been in charge of Henri Bossière. His brother, who has been foremost in all the work, has not yet seen the island in which, for 17 years, he has been striving to awaken an interest. In all respects, the two visits to the island have been very encouraging. In 1908, 20 ewes, 2 rams, 3 horses and some hogs were landed on the island. The chief fodder plant, the *Acaena,* was found in great abundance and was greedily eaten by the horses, sheep and hogs. The plant was wide spread, more than knee high, and would give sustenance to many thousands of sheep. When the expedition departed, the 22 sheep and the hogs were left on the island. In the following year, 1909, the sheep were found to have more than doubled. The lambs were strong and as frisky as kids. Most of them were born on the threshold of winter, but they had suffered no ill results from the inclemency of the bad season. Left

on the island without shelter or any provision for their maintenance, the sheep appear to have lived well by browsing on the roots and shrubs which are in great abundance.

Grain pastes had been provided as food for the hogs, but, to a great extent, they neglected this provision to feed on the same nourishing roots. The brothers have faith in this experiment as affording positive proof that stock-raising on the island may be carried on with great success. Why, they ask, should not hundreds of thousands of sheep be raised on Kerguelen with good care when a few of these animals have actually thrived there, through the winter, without care.

The summer conditions, they say, are all right, and the winters are by no means severe. The mean summer temperature is about 45° F., and the mean winter temperature is about 29° F. Mr. René Bossière writes that if the climate of the island is far from being perpetual spring, it may be said somewhat to resemble continuous autumn. The maximum temperature observed by Henri Bossière in the summer of 1908 was 68° F. Two men of the party remained on the island during the winter intervening between the two expeditions. They kept regular temperature records and the lowest temperature observed in the winter months was —17.6.° F.

The fishing experiment was a great success. In the first season, 232 whales were captured, all valuable in commerce, and one of them is among the prominent whalebone whales, which were supposed to be extinct in far southern waters. Curiously enough, René Bossière had enlarged in his pamphlets on his theory that the evidence of the extinction of the southern whalebone animals was inconclusive, and he argued that, very likely, they would be rediscovered in the wholly unfished waters around Kerguelen.

A little settlement was made in Royal Bay, on the south side of the island, and here the blubber was conveyed for trying out the oil. This is the first established center of human population on Kerguelen, and it appears on the new maps as Port Jeanne d'Arc. The whaling industry has opened auspiciously and the brothers say that much better will be done in future. They recall that when Captain Larsen reopened the southern whaling industry at South Georgia, a few years ago, he captured only 200 animals in the first season; but the business has now grown to about 1,000 whales a year. Sea elephants and other marine game are also included in the programme of the future industries in Kerguelen waters. It is expected to make Port Jeanne d'Arc the maritime center of the island

and to establish communications with South Africa, which will be the base of supplies.

It has long been known that there is coal in Kerguelen and the brothers published two analyses of this mineral as they have found it in different parts of the island. They say that it burns well in stoves and in the furnaces of their steamers, but its value in the development of the island cannot be estimated until the extent of the coal measures has been ascertained.

Another steamer, the Espoir, of 500 tons, left France for the Island in October last. It is proposed to give large attention to the development of animal-growing and, hereafter, to give shelter to the young lambs, if it is found that they would thrive better with such care. The whaling industry promises to be very profitable, and though the Norwegians have been admitted as co-workers, the Bossière brothers have relinquished none of their concessionary rights. The sea elephant was hunted, early in the last century, by hundreds of ships, and, according to the *Challenger Reports*, the animal had almost completely disappeared by 1840. But they are found to-day, in vast numbers, in the waters around Kerguelen and have established their breeding places (they belong to the seal family) on the island. Their skin and blubber are highly valued and the industry is likely to approach that of whale fishing in value. The brothers are sanguine that the raising of sheep, cattle and hogs will be very profitable, express the conviction that Kerguelen will become a prosperous colony and add:

"We may be permitted to hope that, while we are working for ourselves, we may deserve the favorable opinion of our country."

GEOGRAPHICAL RECORD

NORTH AMERICA

Study of American Desert Areas. The Desert Botanical Laboratory of the Carnegie Institution of Washington is engaged in much work which is of interest to geographers. Under the direction of Dr. D. T. MacDougal it is not only carrying on most important investigations upon the relation of plants to the environment of deserts, but is doing actual exploration and other distinctly geographic work. Some of this work has already been described in articles by Dr. MacDougal upon the Salton Sea, the Desert of Papagueria (*Bull.* Vol. 40, 1908, pp. 705-725), and the Delta of the Colorado (*Bull.* Vol. 39, 1907, pp. 705-729).

During the past spring Prof. Ellsworth Huntington, of Yale University, has been cooperating with the Laboratory in a study of American deserts as compared with those of Asia. The work of the present season was confined chiefly to southern Arizona in the vicinity of Tucson, the site of the Desert Laboratory, and to the adjacent parts of the Mexican state of Sonora. From Tucson, trips were made in various directions to a maximum distance of 200 miles. An automobile was used most of the time. It proved to be admirably adapted to this kind of work where it is often necessary not only to travel great distances over the vast slopes of piedmont gravel which Tollman has called "bahadas," but also to carry water for several days.

The work thus far has been of a preliminary nature. In order to give it a certain completeness, however, two basins were chosen for special study. One was that of the Santa Cruz river, which rises on the Mexican border and flows north through Arizona, past Tucson, to the Gila river. The other was the Asuncion, formed by the junction of the Altar and Magdalena, which rise not far from the Santa Cruz, and flow southwestward through Mexico to the Gulf of California.

The first feature which strikes the student of deserts in southern Arizona and Sonora is the great amount of arboreal vegetation in proportion to the rainfall. This phenomenon leads naturally to a study of the relation of the climate of the country, with its summer and winter seasons of rainfall, to the climatic belts of the earth as a whole, and to certain regions of monsoon deserts in northwestern India in particular.

Another interesting subject of study is the topographic forms due to prolonged aridity, a subject which has been more or less frequently discussed since Blanford wrote his famous paper on Persia over thirty years ago. The allied question of the effect of changing climatic conditions upon topography has been almost entirely neglected, in spite of the fact that all geologists admit that the climatic conditions of the glacial period must have been subject to quite as much change in deserts as in glaciated regions. A good deal of time was therefore devoted to a study of the terraces of gravel which are found along almost every river in the arid parts of North America, and which may be of climatic origin. As an aid in their investigation it was found desirable to obtain as full data as possible on the present action of streams during floods and dry seasons, and particularly on the river channels which, in scores of places, have been cut to a depth of from ten to fifty feet during the last thirty years.

A study of terraces leads almost inevitably to attempts to date them, and this opens the question of the occurrence of changes of climate during historic times. Somewhat to Prof. Huntington's surprise, he found that southern Arizona is full not only of the well-known ruins which have been so much discussed, but of others which have never been described, or, for the most part, even noticed by scientists. They are insignificant in appearance, being merely rows of stones, low mounds, and patches of pottery. They are of great age, certainly 1,000 years old in many cases, and in some cases probably 2,000.

As they occur not only in the regions where agriculture is now carried on, but in many places which are now uninhabitable, it appears probable that the population was one far denser, than now. The peculiar character of these relics of ancient civilization, and especially the location of certain old fields seems inexplicable unless climatic changes have occurred. In order to test this conclusion

the investigator attempted to reconstruct the economic conditions of the primitive people who inhabited the ruins, and of the Indians who drove them out, or at least succeeded them. The most significant feature of the evidences as to the climate of the past 2,000 years is the remarkable agreement between America and Asia.

The spring of 1910 was an extremely bad one for the farmers and cattle men of Arizona by reason of drought. For the same reason it was of unusual interest to students of climate. Dying cattle, barren fields, dry springs, and discouraged settlers presented a forcible illustration of the manner in which the density of population is strictly limited by climatic factors wherever the inhabitants depend upon the soil without extensive means of transportation.

A preliminary report of Prof. Huntington's conclusions will be published shortly by the Carnegie Institution.

Movement of Lake Superior Iron Ores. The U. S. Geological Survey has issued a short report by John Birkinbine, statistician of iron production, on the movement of Lake Superior iron ores in 1909. The total shipment amounted to 42,504,110 long tons, a quantity greater than that shipped in any preceding year. Most of this ore was shipped by water. The principal shipping docks are at Two Harbors and Duluth, Minn., Superior and Ashland, Wis., and Marquette, Mich. Nearly 36,000,000 tons shipped from the docks passed through the Sault Ste. Marie canals and through Lakes Michigan and Huron to their places of destination, the greater part of the ore being delivered at Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, and Conneaut, Ohio; Erie, Pa.; and Buffalo and Tonawanda, N. Y. Most of the ore received at these ports is consumed in eastern Ohio and western Pennsylvania. In 1909 about 23,000,000 tons were sent to the Cleveland and Pittsburg region. The Lake Superior ores represent about 80 per cent. of the total iron-ore production of the United States.

Geological Survey of Canada. Mr. R. W. Brock, Director of the Geological Survey, in his *Summary Report* for 1909 (307 pp., Ottawa, 1910) says that his staff is too weak, numerically, to accomplish even the most pressing work in a country so large as Canada, and, to some extent, outside assistance was engaged for geological, topographical and ethnological field work. Almost all of the work was along strictly economic lines. It included mapping, working out geological structures, investigating economic possibilities and in other ways securing and making known the geological information required by the prospector and minor to promote the locating and opening of deposits of economic minerals. While the geologists of the survey are not engaged in prospecting, they sometimes make important discoveries. During the year, Mr. Cairnes discovered a new occurrence of coal in the White Horse district and Mr. Dowling found a new and apparently important coal basin in Alberta. Mr. LeRoy's work in the Slocan will stimulate mining there and assist in the discovery of new ore bodies. The facts learned by Mr. Dresser, as to the occurrence of asbestos, afford a valuable clue in prospecting for this important mineral. The scientific investigation of the clays of the Maritime provinces by Dr. H. Ries of Cornell University and Mr. J. Keele opens an important series of studies, which, it is hoped, may be extended to cover the settled portions of the whole Dominion. It has become important to correlate and compile the information on a particular subject into one handy volume for reference. A beginning has been made in this direc-

tion, an official has been appointed to give his whole time to the work and several volumes have already appeared or will soon be published. Most of the volume is given to reports on the work done during the year.

SOUTH AMERICA

Exploratory Work in Bolivia. The *Bulletin* for April, 1909, vol. 41, contained a note on the work of Major P. H. Fawcett in surveying the boundary between Bolivia and Brazil. Since that time two articles have appeared by Major Fawcett: "Survey Work on the Bolivia-Brazil Boundary," *Geog. Journ.*, vol. 35, 1910, pp. 163-166, and "Explorations in Bolivia," *Geog. Journ.*, vol. 35, 1910, pp. 513-532. The former is a report of progress of the Bolivia-Brazil Boundary Commission for 1909; the latter is a complete account of the South American explorations of Major Fawcett up to this time.

The "Explorations in Bolivia" discusses three points: Some general features of Bolivia apart from political and commercial conditions, the nature of exploration in the uncivilized parts of South America, and such personal observations as the author was able to make during the boundary explorations that have been carried on during the past few years. The article brings again to our attention with great emphasis the danger to human life in conducting exploratory and developmental enterprises on the tropical plains. On the lower Beni 25% of the crews of the river boats perish annually of accidents and fever. Of a party of 23 men sent into the upper Madre de Dios 6 years ago to look for rubber only 3 returned, the others died of starvation and its effects. All but 7 of an expedition of 300 peons died while exploring the Rio Blanco, a tributary of the Abuna, a few years ago. Five of the 6 peons on Fawcett's boundary expedition north of Matto Grosso died after their return through fever and the after-effects of starvation. Scores of expeditions have in the past been lost, decimated, or rendered useless through lack of strong constitutions, or through want of determination or experience. Although he has unlimited resources at his disposal, Major Rondon, who is constructing a telegraph line from Cuyaba to the falls of the Madeira, suffers tremendous losses in officers and men in his little army of 500. The pest of insects can not be adequately described. They so reduce and annoy the traveler and resident that fever finds the body an easy prey.

Two other difficulties, the sudden and extreme changes of temperature and the lack of laborers and trails for transportation, are discussed. At Riberalta, 11° S., a change from 104° to 44° has been recorded in two hours; and in August, 1908, a drop from 78° to 41° was observed. These sudden changes are common from May to October and are the usual accompaniments of south winds that last from two to four days with rain.

The difficulties of securing adequate labor supply is everywhere the dominant one and even transcends the diseases, the heat, and the insects, in the problem of developing resources. Peons are usually unobtainable at any price. Both the Indian and the half-breed are unreliable, difficult to please, lazy, and desert without notice. East of the Bolivian Cordillera, riches are measured by the number of men at the command of an individual. A man with 50 peons is said to be a capitalist. Forced labor is the result, and in its train have come all the evils of race hatred and warfare. A perpetual war of reprisals is waged between civilized and savage men. That slavery actually exists in the Amazon

basin is a fact that is hidden partly by the word "peonage" and partly by the stout denials of the rubber men, whose business rests directly upon the evil system.

Without at all criticizing this valuable paper in regard to details of observations made by the author, we may yet say that some of the general statements need modification. The broad statement that there is coal on the high plateau of Bolivia and coal in quantities east of the mountain belt might be thought to mean a great deal; as a matter of fact, the extent of the coal resources is undetermined, but it is reasonably clear that there is very little indeed on the plateau. Nor can irrigation alone solve the problems of the high plateau. The climate is irremediable, much of highland Bolivia is barren salar and steep mountain slope, and the available water, even if skillfully employed, would not irrigate all of the land. I. B.

AFRICA

Belgian Emigration into the Congo. In order to promote colonization in the Katanga District of the Belgian Congo, from the mother country, the Government has decided to give to approved colonists and their families free transportation (third class) from Belgian to Katanga and free freightage for their household effects and implements of labor. This aid will be extended only to those who are 21 years old or over, healthy and with sufficient means to establish themselves in the new country or who have a contract assuring them of employment in Katanga. This district is the center of the chief mining interests of the Belgian Congo and is one of the most elevated and least unhealthful parts of the Colony (*Kol. Zeitsch.*, No. 17, 1910).

Lake Chad and Climatic Changes. Contradictory reports continue to come regarding the evidence of changes of climate to be found in the Lake Chad region. The general view is, probably, that the lake is diminishing in size as a result of a change (or oscillation) of climate to a drier period. In *Petermann's Mitteilungen* for January, 1910, Dr. Hugo Marquardsen emphatically expresses the opposite view. "Personally," he says, "on the basis of all the results of exploration and of my own observations, I have reached a very different conclusion." At the present time, the writer agrees that there is a marked retreat of the waters of the lake, but this phenomenon cannot be shown to have existed far back. From 1823 to 1902 there was no diminution in the size of the lake. The present loss of water began suddenly after 1902, and is therefore not to be attributed to any permanent climatic control. R. DeC. W.

ASIA

Dr. Sven Hedin's Meteorological Observations in Tibet. In the June number of *Petermann's Mitteilungen* there is published an account of Dr. Sven Hedin's travels in Tibet in 1906-08, in which the meteorological results are briefly reviewed. A full study of the data has not yet been made. The region is one concerning whose meteorology practically nothing has thus far been known. Dr. Hedin took observations thrice daily during the whole period of his journey, including pressure, temperature, humidity, direction and force of the wind, cloudiness and rainfall, together with notes on other phenomena such as insolation, temperature of lakes and springs, etc. Nearly twenty months were spent, with the cara-

van, under a pressure of about 15.75 inches, at three miles above sea level. Greater altitudes were reached, as *e. g.*, the Dingla Pass, July 8, 1908, where the altitude was about 19,300 feet and the pressure below 15 inches. The strong constitutions of the men and animals living at these great altitudes is noteworthy; yaks, antelopes, donkeys, cattle, sheep and dogs are all unusually strong and active. Dr. Hedin's observations showed temperature ranges between 68° and -40°. Even in the most severe winter storms the temperature was observed to be between -5° and -20°. Precipitation comes in all seasons, the winter snowstorms being especially severe. The intensity of insolation is naturally very great. Dr. Hedin points out that the summer is much rainier than the winter. In winter, more snow falls in western Tibet than in eastern, while in summer it rains more in eastern Tibet. There is more snowfall on the highest elevations of the Trans-Himalaya in summer than in winter, a fact which is explained by the moisture brought by the southwest monsoon. R. DeC. W.

POLAR

Plans of the British Antarctic Expedition of 1910. Captain R. F. Scott's large steam vessel, *Terra Nova,* left Cardiff for the south on June 15. Capt. Scott has outlined the plans of his expedition (*Geog. Journ.,* Vol. xxxvi, No. 1, pp. 11-20), and the following facts are taken from this publication:

The *Terra Nova* is expected to reach Melbourne, *via* Cape Town, about Sept. 13. After a week at Melbourne, the vessel will go to Sydney and thence to Lyttelton, New Zealand, which she will reach about Oct. 13. Here she will take on petrol for the motor sledges, forage for the ponies, frozen mutton, the motor sledges and twenty ponies and thirty dogs which Mr. Meares has been collecting in Siberia. The expedition will leave New Zealand towards the end of November and hopes to reach McMurdo Sound, South Victoria Land, about the end of December.

The party numbers fifty men, of whom sixteen constitute the scientific staff. The list of officers, staff and men is appended to Captain Scott's statement.

At McMurdo Sound, the hut, provisions and equipment of the western party will be landed. This party will include twenty-two to twenty-five persons, and, by the third week in January, when sixty to seventy days still remain for traveling, most of them will start south to lay depots. At the same time, the vessel will steam east to land the eastern party on King Edward VII Land. If a suitable spot can be found for wintering, six or seven men will be left here, with full equipment, for the exploration of this unknown land in the following summer.

The ship will then return to McMurdo Sound and then proceed northward, probably about the third week in February. If sufficient coal remains, she will investigate the pack in the region of the Balleny Islands (directly north of South Victoria Land) and pass westward through or to the south of these islands. Captain Scott hopes that thus she may throw some further light upon the coastline between Cape North and Adélie Land (a part of Wilkes Land). This work and biological investigations will occupy the ship during March, after which she will return to New Zealand.

Captain Scott hopes that, by the end of April, the western party will be all safely re-established in the hut with depôts of supplies laid well south on the Great Ice Barrier (extending southward, across Ross Sea, to the continental coast). As the excessive winter cold does not begin to subside till September

and the conditions of travel are severe, even in October, he does not propose to start on the southern journey till October. That month and November will be spent in crossing the ice and ascending the glacier, and he hopes to reach the upper continental plateau early in December. It would be an ideal day to reach the South Pole, if it might be attained on Dec. 22, when the sun achieves its maximum altitude. With his special 4-inch theodolites and the sun at an altitude of 23°, the position of the pole could be determined within one mile. But Captain Scott does not lose sight of the fact that the attainment of the pole is by no means a certainty.

Lieut. E. R. G. R. Evans, of the Royal Navy, who has had Antarctic experience, will be second in command and will remain with the western party. Lieut. Victor Campbell, an ex-naval officer, will be in charge of the eastern party. Five members of the staff and seven members of the crew have had previous Antarctic experience. Dr. E. A. Wilson, zoologist and artist, will be chief of the scientific staff. Three geologists, Mr. T. Griffith Taylor, Mr. W. G. Thompson and another to be chosen in Australia will serve, one with the eastern, one with the southern or polar party, and the third will have a roving commission to explore Victoria Land within easy distance from the western station. Messrs. E. W. Nelson and D. G. Lillie, biologists, will have charge of the study of marine fauna. Five hundred fathoms have been fixed as the limit at which dredging operations can be conducted. Meteorology will be in charge of Dr. G. C. Simpson of the Meteorological Department of India. He will have a special hut and space for a very large outfit of scientific instruments. He will also undertake the magnetic and gravity observations on shore, auroral photography and make studies in other branches of physical science. Mr. C. S. Wright will be chemist of the expedition.

On ship board, Lieut. H. H. L. Pennell will have charge of the magnetic and meteorological records, assisted by Lieut. H. R. Bowers, and also of the survey or resurvey of any lands that may be visited by the *Terra Nova*. Surgeons G. M. Levick and E. L. Atkinson will look after the health of the men and also serve in scientific capacities, the former being a zoologist and botanist and the latter a bacteriologist. All members of the expedition have been medically examined and found fit for the work and have shown great enthusiam for the arduous responsibilities before them.

EDUCATIONAL GEOGRAPHY

THE JOURNAL OF GEOGRAPHY. With the number for June, Prof. R. E. Dodge retired from the editorship and management of this educational magazine. He founded the *Journal,* and eight volumes, each containing ten monthly numbers, have been issued by him. The place of publication is now transferred from New York to Madison, Wis., the Department of Geography of the University of Wisconsin having assumed the work of continuing the magazine. Prof. R. H. Whitbeck, of that institution, is the new editor, and the first number under his direction will be issued in September, soon after the re-opening of the schools.

It is gratifying to know that the work inaugurated by Prof. Dodge is to go on. The publication is needed. It has been devoted to the interests of teachers of geography in the elementary, secondary and normal schools. It has had a marked tendency to raise the standards of geographical education, which, not

many years ago, lagged far behind those of nearly all other great nations. The *Journal of Geography* has been conspicuous in the movement to give teachers clearer ideas of the content of geography, to introduce more effective methods of instruction and to place in the hands of boys and girls better textbooks and better maps. It has helped to bring about the marked improvements that have been made. But a great deal remains to be done before school geography at home is placed upon the high plane which it occupies in some of the European countries; and there is good reason to believe that this periodical will continue to exert a helpful influence that could not well be spared.

PHYSICAL GEOGRAPHY

Climatic Variations. Henryk Arctowski, well known to meteorologists, is at present engaged in a far-reaching investigation of simultaneous climatic variations over the earth's surface. Some of the results already reached are discussed in a recent monograph entitled *L'Enchainement des Variations Climatiques* (Brussels, Soc. Belge d'Astron., 1909). The author has begun his work with a study of the annual mean temperatures, and in order to secure a comparable series of observations he has thus far limited himself to the ten-year period 1891-1900. For these years he has collected the observations for 804 stations,—an immense labor, which has involved the examination of thousands of publications and the writing of hundreds of letters for information. Of these stations 490 are in Europe, 97 in Asia, 38 in Africa, 134 in the two Americas, and 45 in Australia. The tables contain more than 20,000 figures. For each year, and each station, the departures between the mean annual temperatures and the mean normal temperature are determined. These differences (negative or positive) are placed on maps, and the points representing the same departures are joined by lines. It then appears that the areas where there are excesses or deficiencies of temperature do not fall accidentally here or there, but that they form vast zones. These zones Dr. Arctowski calls *thermopleions* and *antipleions*. More than 150 of these maps are given. It is seen that the temperature of the earth's atmosphere has been higher during the years 1896 to 1900 than between 1891 and 1895, the positive excess for the whole globe being between 0.4° and 0.9° F. The displacement of the annual pleions and antipleions is apparently very irregular, but there seem to be real centers from which the variations originate. In order to investigate further the mechanism of the formation of pleions, to find the laws which govern their displacement, to learn to predict the regions which will have excess or deficiency of temperature, and where the crops may therefore be inferior or abundant, the author has decided to investigate the monthly means of temperature, as well as pressure. The whole study is a very important one, and further results will be awaited with great interest.

R. DeC. W.

GENERAL

The Tenth International Geographical Congress. The committee that is making arrangements for the meeting of the Tenth Congress which will be held in Rome next year, has issued its first circular. The time of the meeting will be Oct. 15-22, a week that will also be given in Rome to the commemoration of the proclamation of the Kingdom of Italy. This event, the committee believes, will

add additional interest to a visit to Rome without interfering with the business of the Congress. The President of the Congress and also of the organizing committee is the Marquis Raffaele Cappelli, President of the Italian Geographical Society. The regulations governing the Congress, printed in the circular, follow the same general lines as those adopted for the earlier Congresses. Eight sections, comprising the principal departments of geography, will be constituted and the languages of the Congress will be Italian, English, German, and French. Abstracts of communications which are proposed for presentation should reach the executive committee not later than April 30, 1911; and all reports on matters originating in previous Congresses, or recommended by the executive sub-committee, must be presented in full not later than August 31, 1911. Delegates to the Congress may be appointed by government, governmental departments, institutions and societies whose interests are geographical, and Universities and other higher schools which maintain professorships of Geography. Those who wish to be members are requested to send in their names at an early date, and upon the payment of the subscription (25 lire or $5) they will receive their ticket of membership and all the information that will be issued from time to time. The treasurer of the Congress is avv. Felice Cordon, La Società Geografica Italiana, Roma, via del Plebiscito, 102. Information with regard to routes and accommodations in Rome may be obtained by addressing the "Ufficio viaggi ed informazioni gratuite," 372-373 Corso Umberto 1, Rome. The programme of excursions will be issued later and the complete programme of the Congress will be sent to all members.

The Oceanographical Museum at Monaco. This museum, which the Prince of Monaco has built, was opened with festivities that extended from March 29 to April 1. It was the occasion of an international gathering of the representatives of scientific societies. The building is a beautiful structure of white limestone, standing on the southern extremity of the peninsula of Monaco. It contains a large collection of apparatus for physical oceanography, collections of marine organisms, labelled in three languages, the nucleus of a fine exhibition of marine industries, and laboratories in which students and investigators of all nations may find the most ample facilities for carrying on their studies relating to the various sciences of the sea. The opening address, delivered by the Prince of Monaco, is printed in full in the *Geographical Journal* (Vol. 35, No. 5, 1910).

The Museum is a part of the Oceanographical Institute which the Prince has established to promote the interests of the science to which he has devoted his life. The first branch of the Institute is the School of Oceanography, which the Prince has founded in the University of Paris and for which buildings are now being erected. Three professors are conducting the work of the school: Dr. A. Berget for Physical Oceanography, Prof. L. Joubin for Biological Oceanography and Dr. Portier for the Physiology of Marine Life. The second branch of the Institute consists of the museum and laboratories at Monaco.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Bygone Days in Chicago. Recollections of the "Garden City" of the Sixties. By Frederick Francis Cook. xvi and 400 pp., nearly 100 illustrations from rare prints and photographs, and index. A. C. McClurg & Co., Chicago, 1910. $2.75 net.

Probably no other man is so well qualified as Mr. Cook to write such a book as this about Chicago. The book is not a history, but it supplies abundantly, and in rich and large variety, the materials for history, for it paints the atmosphere and gives insight into the psychology of the young and lusty days of a great city in embryo; and, in an important sense, Mr. Cook was a part of what he saw and heard. He was a keen, alert and trusted newspaper reporter in a day when Chicago was so small that such a chronicler of the times as he, was acquainted with every one of consequence, was the repository of secrets as well as of news and gossip and knew just what was going on in all the strata of Chicago's life and activity. He has given in this book a most graphic picture of Chicago as a stripling, and it is all presented, not in the form of historical narrative but in the way of incident, anecdote and shrewd characterization of men and events. It is one of the most readable books of recent publication; and everything in it seems to have its own value for the light it throws upon those remarkable times and the manner and quality of the men who helped to build the foundations of Chicago.

Camp and Camino in Lower California. A Record of the Adventures of the Author while exploring peninsular California, Mexico. By Arthur Walbridge North. With a Foreword by Admiral Robley D. Evans, U. S. N. 346 pp., illustrations, bibliography and index. The Baker & Taylor Company, New York, 1910. $3.

Mr. North loves the fascination of the wilds. Years ago, he chose as the scene of his adventures the most utterly neglected wild he could find on our continent and that, of course, was the large peninsula of Lower California. He may almost be said to have made that great adjunct of Mexico his own special preserve, for he is the only English-speaking American and, as far as we know, the only man who has ever traversed it from end to end, zigzagging his way over the Sierras and across the desert plains between the Pacific and the Gulf. Mr. North is, to-day, our best authority on the geography of Lower California, and his first book, "The Mother of California," is the repository of a large number of hitherto unknown facts about that unique and untraveled region.

It is gratifying to see that the author has reproduced in the Appendix to the

present volume a succinct account, from his earlier work, of the natural features of Lower California. It is the best, condensed statement of the geography of Lower California that we have; and it is the fitting groundwork for this book-full of his adventures among the wild game of the mountains and the plain, among the Indians, the Mexicans, the Missions and the petroglyphs painted and drawn on the rocks by unknown predecessors of the present population. The volume is not only very entertaining, but has also distinct value for the added light it throws upon existing conditions and many phases of life in the peninsula.

The Life of George Grenfell. Congo Missionary and Explorer. By George Hawker. xxvi and 576 pp., 70 illustrations from photographs, 5 maps and index. Fleming H. Revell Company, New York and Chicago, 1909. $2.

George Grenfell was a great explorer as well as a great missionary. Next to Alexander Delcommune, he revealed to the world more of the Congo basin than any other man. He was the pioneer explorer of several of the large southern tributaries, he discovered the lower part of the Mobangi affluent, the largest Congo tributary, and ascended it for 400 miles; and he made the best survey and map of the Congo between Stanley Pool and Stanley Falls that has been produced. He ranks among the great African explorers, and the Founder's Medal which the Royal Geographical Society bestowed upon him was a just recognition of his merit.

At the same time, he never lost sight, for a moment, of the missionary service to which he had dedicated his life. He not only preached the gospel, but he believed in the industrial education of the natives and was a powerful influence in promoting it. The future prosperity of the Congo will depend, to quote his own words, upon "the gradual development of a more or less educated community, with a personal interest in the exploitation of the resources of their country."

It was agreed that Sir Harry Johnston, in his book on Grenfell, should treat of him as the explorer, while Mr. Hawker, in the present volume, should deal with the missionary side of the man. But Grenfell was a missionary who was always an explorer and an explorer who was always a missionary, and it is very difficult to keep the two phases of his great work apart. We see not a little of the explorer in this book, but, after all, the great, modest missionary dominates. In this volume is finely revealed the man who gave his life to the Congo peoples, his practical common sense, his fullness of resource, his gentleness, the love the people gave him and the good he did.

Die Vereinigten Staaten von Amerika. Ihre politische, wirtschaftliche und soziale Entwicklung. Von Dr. Paul Darmstaedter. vi and 242 pp. and index. Quelle & Meyer, Leipzig, 1909. M. 4.

The author is professor of history in Göttingen. The small size of the book imposes great limitations upon the historical treatment of the United States from its colonial days to the present time and the author's attention is necessarily confined to the essence of things. He attempts to give only those factors and results of our political, industrial and social development that count most in a correct appreciation of this country. From our own point of view, it may be said that he has succeeded admirably in this effort. The book has no resemblance to those

"Compendiums" which give only the bones, not the life of history. He touches the larger aspects of our history, and describes and discusses them in a clear and illuminative manner. We may be gratified that this little work will tend to impress its readers with a deep and accurate perception of the genius of this American nation and the circumstances and conditions that have so largely shaped its development. Each of the many sections is introduced by a bibliography. The work is a good example of the results of painstaking and thorough research which so many German scholars exemplify in their writings.

The Cleavage between Eastern and Western Virginia. By Prof. C. H. Ambler. *American Historical Review,* July, 1910.

In this paper, Prof. Ambler, of Randolph-Macon College, shows a keen appreciation of the geographic differences between transmontane and cismontane Virginia and the marked economic and political differentiation of these two districts largely as a result of their geographic contrasts. Prof. Ambler takes the Blue Ridge as the boundary between the two sections and describes eastern Virginia as a relatively level region with fertile soil, a deeply indented coast line and temperate climate, while western Virginia is described as having a more broken and mountainous or hilly surface, less fertile soil and a more rigorous climate. In the East was the plantation and its concomitant slave system, producing staple crops which found easy shipment at the deeply drowned river valleys of the tidewater region. As a result of the self-sufficing plantation system and the poor transportaton facilities, villages and trade centers were not developed. In the West, the small farm operated by individual owners was the rule. Villages were relatively frequent and were centers of trade and influence.

Politically, the two sections were usually antagonistic. In the movement for independence, the western counties led the more conservative East. On national questions, the Piedmont and tidewater country were inclined to be individualistic. The mountain region, with its early need for protection against savages and its subsequent need for facilities to transport its coal and agricultural products, demanded a strong central government.

The author traces the struggle of the West with the East for political equality in the Assembly, a struggle so bitter that, from 1830 to 1850, there was a strong movement for a new commonwealth west of the Blue Ridge. Not until 1850 did the white population in western Virginia outnumber that in eastern Virginia and secure a fair representation in the Assembly. The slavery controversy appears not to have been strongly geographic. The people of western Virginia were in favor of allowing slavery, although the number of slaves was relatively very few. This section had voted against the resolutions of 1798 and the nullification movement, but the final dismemberment of Virginia was upon the question of secession. The mountainous west remained with the North while the Piedmont and Tide Water joined the South.

A geographer, perhaps, would wish that the geographic factors were more adequately described. A concise description of the rolling Piedmont, the smoothly sloping Coastal Plain with its drowned valleys, the maturely dissected plateau in West Virginia separated from the Blue Ridge by the level floored Great Valley, would give the reader a mental picture of the two contrasted regions. The climate of east and west Virginia is characterized respectively as "even" and

"uneven." This fails to convey the contrast between the milder, shorter winters and the shorter frost season of the East and the larger range of temperature, longer winters and longer frost season of the west. F. V. EMERSON.

Distant Lands—An Elementary Study in Geography. By H. J. Mackinder, M.A. xvi and 296 pp., 210 ills. and 12 colored maps. 8vo. George Philip & Son, London, 1910.

Professor Mackinder's Geographical Studies, of which this is the third, treat the subject in a progressive manner, so that the pupil comes gradually into a knowledge of the whole world. This volume, like the second, is both historical and geographical. There are good maps, many being orographical; and it may be noted that they are up to date, northeast Greenland, for example, having the latest delineation after the results of the Erichsen expedition. Every young student will find approved geography in these books, and there could be no better preparation for the more advanced study of the subject.

Tropical Medicine, Hygiene, and Parasitology. A Handbook for Practitioners and Students. By Gilbert E. Brooke, M. A. Cantab., etc. With numerous illustrations, including 26 plates. Small 8vo and 498 pp. Charles Griffin & Co., London, 1908. 12s., 6d.

An important work for the physician or traveler in tropical countries, written by a man of long and varied experience in these fields. There are descriptions of diseases and their treatment, much practical information as to food, exercise, clothing and general hygiene; and a description of mosquitoes, fleas, ticks, etc.; and classifications of animal and vegetable parasites; also a chapter on disinfection, one on the blood, and advice on microscopy and photography, two most valuable assistants in the field of pathology. The author has been successful in his task, which, he remarks, has been a pleasant one.

Ober-Ammergau and the Passion Play. A Practical and Historical Handbook for Visitors, by the Rev. E. Hermitage Day, D.D., F.S.A. 96 pp. and 24 illustrations. Small 8vo. A. R. Mowbray & Co., London (1910). Milwaukee, The Young Churchman Co. 45c., parchment.

This little volume, giving a concise and accurate account of the Passion Play, including a description of the village, is most welcome. There is added a synopsis of the play and other data of value to those who are there or who intend to witness the performance. For others, the book will be of interest in its descriptions and will serve as a reference work on the subject.

El Inglés para Cada Cual. Con Pronunciación Fonética. Para aprender el Inglés por sí mismo. Por William Chevob. pp. 128. 8vo. E. Marlborough & Co., London, 1909. 1s.

Handbooks of this practical kind for language study are highly useful and enable many to acquire foreign languages. Marlborough & Co. have published a large number of them, including Arabic, Hindustani, Japanese, Tamil, and even Esperanto. Pronunciations in all cases are quite clearly indicated. Any intelligent person may "pick up" a working knowledge of a language through these books.

Historical Furniture. A Description of the "Queen Mary" and "Prince Regent" Suites, presented by Syed Sirdar Ali Khan, eldest son of the late Nawab Sirdir Diler Jung Bahadur, C.I.E. of Hyderabad (Deccan), to the Victoria Memorial Calcutta. 8vo pamphlet, 16 pp. and 7 plates. The Times Press, Bombay, 1908.

From London to Brighton, from Brighton to Hyderabad, from Hyderabad to Bombay is the record of the journey which finally landed these two splendid suites of Jacobean furniture in India and into the possession of Syed Sirdar Ali Khan, who now presents them to the Victoria Memorial at Calcutta. There is much interesting history connected with the pieces. There is a description of some pieces and photographs of several.

L'Anglais Sans Maitre. Avec la prononciation de tous les mots. Pour apprendre l'Anglais Soi-même. Quatrième Édition, Revue et Agrandie par M. H. Hébert. pp. 128. 8vo. E. Marlborough & Co., London, 1909. 1s.

Ireland and Great Britain in Outline. By J. B. Reynolds, B.A. viii and 184 pp. 8vo. Adam and Charles Black, London. The Macmillan Company, New York, 1910. 50c.

The series of small volumes, of which this is one, on Regional Geography, are admirable for use in the class-room. The method is simple, adequate and comprehensive.

Unteritalien und Sizilien. In Neuer Bearbeitung. Fünfte Auflage Mit 21 Karten und 37 Plänen und Grundrissen. Leipzig und Wien, 1909. Small 8vo. xii and 372 pp. (Meyers Reisebücher) Bibliographisches Institut, Leipzig, 1909.

This new edition of the standard "Gsell Fels" guidebook to Southern Italy and Sicily has had the advantage of a thorough revision by Dr. Schoener on the ground. There are excellent maps of the south part of Italy with Sicily, and of Sicily on a fairly large scale by itself. The plans of the towns are extremely clear and those of Naples, Palermo and Messina are on a good scale. Pompeii has a careful map and there are some two dozen pages of text devoted to this subject. For any traveler conversant with the German language this book will be found most desirable.

The Mechanics of the Earth's Atmosphere. A Collection of Translations. By Cleveland Abbe. Third Collection. Smithsonian Miscellaneous Collections. Vol. 51. No. 4. Pp. 617. Large 8vo. Washington D. C., 1910.

Professor Abbe is in many senses the mainstay of meteorology in the United States. For years he has been doing the most careful and laborious work in order to establish the science of meteorology upon a firmer basis, and to encourage more advanced instruction in the subject. An important part of this work has been the translation of a large number of German, and other foreign memoirs bearing on the mechanics of the atmosphere. Of these collections there have been issued "Short Memoirs on Meteorological Subjects" (Smiths. Rept. for 1877, pp. 376-478), and "The Mechanics of the Earth's Atmosphere" (Smiths. Misc. Coll., 1891). In the present volume Professor Abbe has brought together a

third valuable series of papers, twenty-four in all, including nine important ones by von Bezold. The well-known memoir by Guldberg and Mohn, on the movements of the atmosphere, translated by Waldo and revised by the writers, is also included. This collection, while not of such a character that it will appeal to the ordinary student or teacher of meteorology, includes a large and very valuable series of papers which those who deal with the more involved physical and mathematical aspects of the science will be glad to have in this convenient form, in English. Professor Abbe may be assured of the increasing debt of gratitude which American meteorologists feel toward him. R. DeC. W.

Practical Guide to Great Britain and Ireland. Preparation, Cost, Routes and Sightseeing. By M. D. Frazar. Two volumes. Vol. I, England and Wales, pp. 473. Vol. II, Ireland and Scotland, pp. 338. $1.50 net per vol. Small, Maynard & Co., Boston, 1909.

Practical Guide to Latin America. Including Mexico, Central America, The West Indies and South America. Preparation, Cost, Routes and Sightseeing. By Albert Hale, A.B., M.D. Small, Maynard & Co., Boston, 1909. $1 net.

These concise little guide-books are, as their titles claim, "practical," and they also offer a large amount of "boiled down" information necessary for the traveler who desires to be comfortable and to use his time effectively. The books, while complete, are not designed entirely to supplant local guide books and Baedeker, but rather to supplement them by covering all points and indicating where other books may be most useful for extended details. Both are written from the American standpoint entirely. The authors are personally familiar with most of the places described, Mr. Hale having also the advantage of official connection with the International Bureau of American Republics.

We have now awakened to the fact that Latin-America is progressing at a more rapid rate than nearly any other part of the world—particularly South America, where magnificent cities like Buenos Aires have over a million of population, with splendid buildings and a life that is quite Parisian. The Transandine Railway is completed through the great tunnel, 10,460 feet long, connecting with Valparaiso, 888 miles away on the Pacific and with the longest piece of straight track ever constructed, running 175 miles without a curve, and with one curve, 206 miles. To him who has seen Old England, the Latin-America guide book will open a new world full of pleasant surprises.

The Wayfarer in New York. Introduction by E. S. Martin. 8vo, cloth. pp. xxii and 266. New York, The Macmillan Co., 1909. $1.25.

This little volume is a medley of selections from various authors who have visited the locality from the day that Hudson sailed up the river, the first quotation being from the journal of the mate "Robert Juet of Limehouse," who afterwards was so treacherous towards his commander. The introduction is written in the clever vein of the author and gives a unique and interesting account of the city as it is now, "not recommended as a birthplace," but excellent for those "who have been born and have more or less grown up somewhere else." "Now it is wonderful rather than charming, a marvelous city that people's eyes pop out over; that changes and develops and shoots up and stretches out so fast

that habitual residents find new marvels for their own eyes every time they show the town to a visitor."

The extracts from authors are well chosen and comprise, Walt Whitman, Peter Kalm, Dickens, Stedman, Bryant, Bunner, O. Henry, John C. Van Dyke, and many others, grouped in ten topographical divisions of the city.

Rapid Night Marching Made Easy. Consisting of Simple Rules for finding the true Bearing by Means of Stars. Suitable for Soldiers, Explorers, and Travellers Generally. With a Description of Reeves' Astronomical Compass and Time Indicator. By Major W. A. Tilney. 15 pp. Edward Stanford, London, 1909. 2s. 6d.

Three methods are given for finding the true bearing of a star, at any hour. The instrument described is a simple appliance for finding the north and south line and the true bearing of any object or direction, as well as the local mean time, by the sun or stars.

Pioneering. By Frederic Shelford, B.Sc., etc. A series of Four Articles contributed to "The Engineer." Revised, 8vo, pp. 82. E. & F. N. Spon, London, 1909. $1.25 net.

Outfitting for expeditions that are to proceed far from the facilities of regulated traffic is a very different matter now from what it was thirty or forty years ago. Besides the assistance of such books as this to-day, one can step into a shop in almost any large city and order then and there almost any thing he requires, tents, boots, guns, special foods,, cooking-kit, made expressly for the rough use of camp and pack-train, and at far less cost than formerly.

The difficulty with any book on outfitting is in adapting it to all conditions and countries. An equipment that in Africa would be perfection, in northern Canada or Labrador would be almost useless. There is a difference, too, between pioneering and exploring, and this book is devoted to the former. The explorer would find it necessary to discard many of the articles enumerated here as desirable.

What explorer, for example, would think of carrying with him a folding tripod washstand—not that this article is not most convenient but that it takes up space, adds to the weight, and is about the least necessary article imaginable. The same may be said of a "Uganda" table or an armchair also advocated. The author says "the experienced explorer or traveler will arrange his kit in such manner that there is nothing wanting from a tent to a tin-opener—from a mattress to a match"; but most explorers arrange it so that there shall be nothing unnecessary. Some, therefore, make a hunting-knife take the place of the tin-opener and dispense altogether with the mattress. Naturally, it depends on circumstances, and the region to be visited; what one intends to do; and the financial backing of the enterprise. In Africa where natives are abundant and cheap, and game is likewise, everything may be carried; but in an uninhabited, trackless country where a few underfed pack animals must worry along with all the supplies needed, one quickly learns to leave the "frills" behind. You can even make a good coffee grinder out of an empty tomato-can when necessary—at least it is easy to pulverize coffee in one if you know how.

The tumblers with wicker covers which the author advises seem entirely unnecessary, for the cups carried are good enough.

His list of utensils is made on the basis of two persons, and he makes the mistake made by all outfitters in allowing but two spoons and two forks, etc., to the two persons. If in a well-watered country, this might answer, as one can wash his spoon to change from coffee to soup or to jam, but in the desert it would necessitate a large amount of licking. Besides, there are no serving spoons, forks, etc. It is better to throw away the washstand and add in its place some extra knives, forks, spoons and cups and the dishwashing can then be done after the meal. For two persons at least six teaspoons and as many of a larger size should be provided. The author also enumerates two enamelled egg-cups, which, in an explorer's outfit, seem very odd. Eggs are not easy for an explorer to carry, and they soon arrive, even if not broken, at a state where the less said the better. So why egg-cups? There is no word about the German Erbswurst, one of the very best camp preparations ever concocted, nor are leggings advised. Whiskey, wine and mineral waters are included, but generally these things are of no value whatever. On the whole it is a useful book and any prospective pioneer or explorer will learn something from it.

The Beginnings of New York. Old Kingston—The First State Capitol. By Mary Isabella Forsyth. Small 8vo, paper, 69 pp. Richard G. Badger, Boston, 1909.

These are two pleasantly written sketches of New York history, the second being reprinted from the *New England Magazine*. The "Beginnings of New York" goes back, of course, to the entrance of Hudson and the start of the first settlement the year after Hudson's visit, that is in the year 1610, just 300 years ago. Two years later forts were established at Albany and at Kingston Point. Kingston, as is well known, became an important place, and remained so. Houses built in the very early period are still standing there and the city will one day be visited more than now for a view of the relics. One of the old landmarks has been made into a museum and so will be preserved, but there are one or two others whose fate is not so certain. In this country we have not yet reached the stage where historical buildings are thought much of, and little books like this do good missionary work.

The March of Portolá and the Discovery of the Bay of San Francisco. By Zoeth S. Eldredge.—**The Log of the San Carlos** and Original Documents Translated and Annotated by E. J. Molera. Illustrations by Walter Francis. 8vo. 71 pp. DeWitt & Snelling, Oakland, Cal. 50 cents.

Probably very few persons East or West knew who Portolá (or Portalá, as it is sometimes written) was until the Portolá Festival in California last year. This volume was the outcome of that festival of October, 1909, commemorating the 140th anniversary of the discovery of San Francisco Bay, by Portolá.

California was a vague country in the 18th century, comprising the peninsula and an unknown, unlimited, tract northward to anywhere, and this volume in its first section tells the story of the march of Don Gaspar de Portolá from the lower, or Baja California to the portion long known as Alta, and the establishment of the first settlement on the coast at San Diego. It was the first land expedition by white men to the region and the actual history of our California begins with this event.

The author tells the story very well and has been careful with his facts.

Portolá was accompanied by Miguel José Serra, better known as Fray Junipero Serra, who went to establish the Church in the new land, and who immediately founded a mission at San Diego, and then many others in the upper country. Mr. Eldredge discredits the popular conception that it was the Church which blazed the way, and lays it rather to political exigencies. While this in a measure may have been the spring behind the occupation, so far as the coast was concerned, it does not appear to hold for the interior, for there the often unaided zeal of the padres broke the path, as, for example, the exploit of Garces, and that of Escalanté.

Portolá is spoken of as the first governor of California, but though perhaps he was nominally governor, it was a title akin to general, for there was no government and nothing to govern, except his own party, during the year that Portolá was there. He reached San Diego June 29th, 1769, and sailed for Mexico from Monterey July 9th, 1770. There is some account of him afterward. He was promoted to Lieut. Colonel and was Governor of Puebla in 1777.

"The Log of the San Carlos," under command of Lieut. Don Juan Manuel de Ayala, from San Blas to San Francisco, is interesting and valuable, as this was the first ship to enter the Port of San Francisco. A summary of a certified copy, now in the archives at Seville, is given, with the report to Bucareli the Viceroy, a description of the bay, and a map by José de Cañizares the pilot. They found the natives friendly, as natives usually are when properly approached. The success of the missions and the practical enslavement of the natives followed the beginnings recorded in this volume, till the *dolce far niente* régime of the padres thrived in a garden of Eden, to be finally shattered by the coming of the American.

The American Natural History. A Foundation of Useful Knowledge of Higher Animals of North America. By William T. Hornaday, Director of the New York Zoölogical Park. Illustrated by 227 drawings and 116 photographs. 8vo, xxv+449 pp. American Publishing Company, Hartford, 1906.

Any work on Natural History bearing the name of Mr. Hornaday is abundantly endorsed at the outset. The present volume is particularly addressed to teachers and parents, and these persons should read the book. There are grown people to-day who will assure you that a hair-snake comes from a horsehair which has lain in water; and Mr. Hornaday declares that "fully ninety-five per cent. of students in grammar and normal schools, academies, and small colleges are so inadequately equipped for the study of natural history, including also the great mass of students from the higher colleges and universities, that they enter active life ignorant even of the most important forms of the wild life of our own country." He offers this book as a filler between the technical zoology of the college and the nature-study of the common-schools.

To make the work attractive he skips the lowest forms and begins at once with mammals. There is an excellent introduction describing "The Ground-Plans of Nature," and this must be read by all who are not naturalists. The book is well illustrated from photographs and drawings which assist greatly in understanding the various subjects. The pictures on page 119 are a good example. The question is often asked, "Do elk shed their antlers?" and the answer is here given in four cuts from photographs. No. 1 shows an elk with

but one horn; No. 2 one with no horn; No. 3 in the "velvet"; and No. 4 with the new horns half grown. The dates are given of each photograph. Deer, moose, and caribou shed their horns similarly. A singular thing about the shedding of antlers is the fact that very few old antlers are seen even in a region where there are or have been many deer. One would suppose that being so hard they would accumulate and that the woods would be full of them.

In the description of that past-master in animal engineering the beaver, Mr. Hornaday states that "It is seldom that anybody sees a live beaver in its haunts during the middle of the day," and thus unintentionally conveys the impression that this animal is always almost exclusively nocturnal. This is hardly correct, for, especially on rivers, the beaver in remote places may be seen all day long in numbers. The writer of this makes the statement from personal obcervation, having years ago seen many beaver and never one at night.

Mr. Hornaday sounds a warning on the rapid disappearance of birds as well as other animals. In every way this is an admirable book.

British Columbia Coast Names, 1592–1906. To which are added a few names in adjacent United States Territory. Their Origin and History. With Map and Illustrations. By Captain John T. Walbran. Published by order of Hon. L. P. Brodeur, Minister of Marine and Fisheries of Canada, for the Geographic Board of Canada. 8vo, 546 pp. and map. Ottawa Government Printing Bureau. 1909.

This valuable addition to the dictionaries of geographic names of North America was prepared by Captain Walbran of the C. G. S. "Quadra" in no perfunctory manner, but with deep interest born of long familiarity with the region. The work began in a small way and grew on his hands till the present fine volume came from the press. "The history of a country is often indicated by its names," says the author, and this remark is especially proven all the way round the North American Coasts. But it is not necessary to go beyond the book itself to substantiate this assertion, the very first item of the list indorsing it," Actaeon Sound" having been named for H. M. frigate of that title; and the second relates how "Active Pass" was named after the U. S. revenue vessel Active. A brief sketch of the Active is added which tells that her former name was Goldhunter. One of her prisoners showed the crew gold dust from the Fraser River Indians and the rush to that region in 1858 was the result. The volume is brimming with valuable historical points. Under "Kitkatla Inlet" there is an interesting page and a half giving a tradition of the Kitkatla Indians, concerning the first appearance of white men, from no less an authority than the noted Mr. William Duncan, who spent his life developing the Metlakatla settlement. These citations serve to illustrate the careful way in which the book has been prepared and its great value to historian and geographer alike.

Bosnia and Herzegovina. By Maude M. Holbach. 8vo. 249 pp., 48 Illustrations from Photographs by O. Holbach and Map. John Lane Company, New York, 1910 (?). $1.50.

Bosnia and Herzegovina were wholly off the tourist routes, a few years ago, but travelers are awakening to the unique and exceptional charms of these two Balkan lands. They are coming into their own, before very long, so far as an influx of tourists may be of advantage to them. They are already the subject

of excellent guide-books, and even the Austrian Government has built a few hotels for the special convenience of the traveling public.

This book was well worth writing, for its author is a good observer, is in love with these countries and tells a great deal about them, their interesting and unspoiled peoples and the unhackneyed beauty and quaintness of this remote part of Europe. The book is thoroughly entertaining, is not superficial and, on the geographic side, it is qualified to be very helpful to most readers.

Castes and Tribes of Southern India. By Edgar Thurston, C.I.E., assisted by K. Rangachari, M.A. Seven Vols. Large 8vo. lxxiii and 3287 pp., and numerous full-page illustrations from photographs. Government Press, Madras, 1909. £1 3s.

These seven large volumes contain the results of researches which no agency excepting a government would be likely to undertake; and yet these books relate only to the peoples of the Madras Presidency, and it is to be presumed that they are but a small part of the publications that are to be issued on the same subject; for the Government of India, in 1901, gave its formal sanction to the scheme for a systematic and detailed ethnographic survey of the whole of India, appointed a Superintendent of Ethnography for each Presidency or Province to carry out the work and provided an annual allotment of funds for each of these districts, extending over a period of eight years.

If these published results of the work in the Madras Presidency are indicative of the content and the volume of the reports to come from all the other parts of India, the whole will form a remarkable contribution to our knowledge of the many different castes and tribes of India and will make quite a large library in itself.

Mr. Thurston, superintendent of the Government Museum at Madras, was appointed superintendent of the ethnographical work in the Madras Presidency. The task set him was to record the manners and customs and physical characters of more than 300 castes and tribes, representing more than 40,000,000 persons and spread over an area exceeding 150,000 square miles. A great deal of assistance was obtained from Europeans and educated Indians in various parts of the Presidency and the literary output is also augmented, to an important extent, by the instructions given to the men in charge to supplement their own researches by the study of "the considerable mass of information which lies buried in official reports, in the journals of learned Societies and in various books." Full advantage was evidently taken of this injunction.

A large amount of anthropometric data was procured and these measurements were all made by Mr. Thurston himself in order to eliminate the varying error resulting from the employment of a plurality of observers. The work also included many phonographic records and photographs. The author says that, in the course of his investigations, he became thoroughly convinced that much further delay in carrying out the scheme of the survey would have been fatal.

"Tribes which, only a few years ago, were living in a wild state, clad in a cool and simple garb of forest leaves, buried in the depths of the jungle and living on roots, honey and other forest produce, have now come under the domesticating, and sometimes detrimental influence of contact with Europeans, with a resulting modification of their conditions of life, morality, and even language. The Paniyans of the Wynaad and the Irulas of the Nilgiris, now work regu-

larly for wages on the planters' estates. I have seen a Toda boy studying for the third standard instead of tending the buffaloes of his mand; the abandonment of leafy garments in favor of imported cotton piece goods; the employment of kerosene tins in place of thatch; the decline of the national turban in favor of the less becoming pork-pie cap or knitted nightcap of gaudy hue; the abandonment of indigenous vegetable dyes in favor of tinned anilin and alizarin dyes; the replacement of the indigenous peasant jewellery by imported beads and imitation jewellery made in Europe—these are a few examples of change resulting from western and other influences."

The arrangement of the information is wholly alphabetical. No index is provided and apparently none is needed. All that is written about any one of these many scores of castes and tribes appears under their name, which is printed in heavy black type and repeated at the top of every page as far as the account of them extends. The work is certainly a treasury of information about these many different peoples; and, as time goes on, many of the facts here given will become involved in the changes now in progress and could no longer be recorded.

Einführung in die Kartenwerke der Königl. Preussischen und Sachsischen Landesaufnahmen. Zweite, vermehrte u. verbesserte Auflage. Von Edmund Oppermann. vii and 106 pp., and 5 map plates. Small 8vo. Carl Meyer (Gustav Prior), Berlin, 1909. M. 1.25.

An excellent discussion of the map products of the Prussian Government treated as simply as is possible in dealing with a technical subject. It gives a brief history of the development of the Government surveys, and has sections on triangulation, the determination of heights, topographic surveys, scales of map sheets, the cartographic development of land forms, plane table sheets, how to use the Government maps in touring, the topographic general map of Germany, plane table sheets as the basis of geological and regional maps, etc. Prof. Diercke has said that a map is a bit of reading and that its contents can be understood only by those who have learned the cartographic alphabet. Such a book as this will greatly help those who master its contents to learn how to read maps and to get from them all the information they contain. Of course, if we have before us a poor map that does not conform to the rules of good map making, and is not based upon scientific surveys, it means few things very definitely and should be discarded if anything better can be obtained.

Report on the Dominion Government Expedition to Arctic Islands and the Hudson Strait on board the C. G. S. "Arctic," 1906-1907. By Captain J. E. Bernier, Officer in Charge and Fishery Officer. 127 pp. 8vo. Ottawa, 1909.

Captain Bernier is as staunch and true an old sea-dog as ever sailed a ship and he is one of the most capable as well as one of the most enthusiastic arctic explorers of our day. Besides planting the Canadian flag on everything in sight, he made a large number of valuable observations and generally kept his eyes open. This volume therefore contains much matter of high value. It describes his 1906-07 voyage and is accompanied by a very good outline map of the northern region, prepared by the Canadian Geological Survey. There are many historical points also, such as copies of inscriptions on the old graves met with, and

of that on the marble tablet left there by Lieut. McClintock, R.N., in 1858, commemorating Franklin, Crozier, Fitzjames, and others. The Franklin Memorial was repaired and a foundation of concrete laid up. There is a short account of the whaling industry in Hudson Bay.

The Teaching of Geography. By L. W. Lyde, M.A. 119 pp. Small 8vo. Blackie & Son, L't'd., London, 1909. 1s.

A suggestive and helpful book by an author and teacher whose writings have been worthy of wide attention. It has long been his view that geography in the schools should be essentially educational and not merely informing. This volume gives the essence of the methods he has found to be most useful. He says: "I do not believe it possible to use School Geography with the best results, in training the imagination, without emphasizing, above all other things, this matter of geographic control—site control and relief control, but especially climatic control."

The Respiration of an Inland Lake. By Edward A. Birge, Secretary of the Commissioners of Fisheries, Wisconsin. Address of the President at the 36th Annual Meeting of the American Fisheries Society, Erie, Pa., July, 1907. Reprinted from the *Transactions,* pp. 223-241. 8vo pamphlet.

The author points out that every inland lake has a respiratory quality, and, in a sense, may be compared to a living being, having its growth, maturity and decay; and many dead lakes may be seen. The lake has an internal and external respiration, absorbing certain gases and throwing off others, which bring about changes in the life-giving property of the water also. There is a great deal in this small pamphlet on phases of lakes that are not generally known.

Im Bismarckarchipel und auf den Salomoinseln 1906-1909. Von Richard Thurnwald. Photo-engravings and map. 8vo. Aus der *Zeitschrift für Ethnologie,* Heft 1, pp. 98-147, 1910.

With the aid of a grant from the Berlin Ethnological Museum, and with the assistance of the authorities of German New Guinea, Dr. Thurnwald was able to devote many months to his studies of these natives. His collections were very large and this paper, giving an extended review of the results of the investigation, is a part of the literary outcome.

Some of the Triumphs of Scientific Medicine in Peace and War in Foreign Lands. By Louis Livingston Seaman, A.B., M.D., etc. Late Major Surgeon United States Volunteer Engineers. Read before the New York Academy of Medicine, 1908. Reprint from the N. Y. *Medical Journal,* and Congressional Record. A. R. Elliott Publishing Company, 1908. 31 pp.

Dr. Seaman's address was made to show, among other things, that the glory of scientific medicine is in the prevention of disease rather than in its cure, that a medical officer in the army must have absolute control in his own department, that neglect of public health is a reflection on our civilization, etc. These points are all well taken and Dr. Seaman's position is impregnable. He shows that in all the wars of the United States disease has been responsible for more than 70 per cent of the mortality. This has been the case in most other wars also, excepting, perhaps, on the side of the Japanese in their last war. And "the sons

of Nippon," he says, "treated their prisoners with far more humanity than our nation does its own soldiers." To die for one's country, therefore, is not to fall before the bullets of the enemy, but to waste away from diseases, the result of stupidity and neglect.

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NEW MAPS

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for geological formations]; (d) Geologic reconnaissance map of the region adjacent to Goldfield. 1 inch=4 miles. After S. H. Ball. Contour interval, 100 ft. Illustrates Professional Paper 66, "The Geology and Ore Deposits of Goldfield, Nev.," by F. L. Ransome and others, Washington, 1909.

PENNSYLVANIA. Map showing outcrop of paint-ore bed near Lehigh Gap, Pa. 1 inch=3,000 feet. Illustrates "Paint-Ore Deposits near Lehigh Gap, Pa.," by F. T. Agthe and J. L. Dynan, in *Bull.* 430-G, "Advance Chapter from Contributions to Economic Geology. Mineral Paints, 1909," Washington, 1910.

UNITED STATES. Map of United States showing mean Annual Precipitation. 1 inch=190 miles. Prepared by Henry Gannett mainly from data of U. S. Weather Bureau. *Water Supply Paper,* 234, Washington, 1909. [10 tints of blue to show average annual rainfall in inches, with percentage of total area covered by each tint.]

UNITED STATES. Known productive Oil and Gas Fields of the U. S. in 1908. 1 inch=110 miles. Compiled by David T. Day. Illustrates "The Production of Petroleum in 1908," Advance Chapter from "Mineral Resources of the U. S., calendar year 1908," Washington, 1909. [Petroleum areas are shown in yellow and natural gas areas in red.]

UNITED STATES. (a) Sketch map of the Greaterville, Ariz. placer camp. 1 inch=1.1 mile. Illustrates "Notes on the placer deposits of Greaterville, Ariz.," by J. M. Hill. [Shows distribution of dikes, veins, formations, placer gravels, etc.] (b) Sketch map of northern part of Trinity Co., Cal. 1 inch=18 miles. Illustrates "The Weaverville-Trinity Center gold gravels, Trinity Co., Cal.," by D. F. MacDonald. (c) Map of a portion of the Sumpter quadrangle, Oregon, showing distribution of gold-bearing gravels with relation to glaciated areas. 1 inch=6 miles. Illustrates "Placer gravels of the Sumpter and Granite districts, eastern Oregon," by J. T. Pardee. In *Bull.* 430-A, "Advance Chapter from Contributions to Economic Geology. Gold and Silver, 1909," Washington, 1910.

UNITED STATES. (a) Sketch Geologic map of part of Idaho-Wyoming border country. 1 inch=5 miles. Illustrates "The salt resources of the Idaho-Wyoming border, with notes on the geology," by C. L. Breger. (b) Map showing the more important soda deposits in Wyoming. 1 inch=110 miles. (c) Map showing location of "Western Alkali Company's soda wells at Green River, Wyo.," with detailed plan of the plant. Illustrate "Deposits of sodium salts in Wyoming," by A. R. Schultz. In *Bull.* 430-I, "Advance Chapter from Contributions to Economic Geology. Salines," by C. L. Breger and A. R. Schultz, Washington, 1910.

WASHINGTON AND OREGON. (a) Map of Washington and Oregon showing distribution of Limestone. 1 inch=75 miles [Limestone areas in black]; (b) Map of Portland, Ore., and vicinity, showing distribution of structural materials. 1:62,500=0.9 miles to an inch. By N. H. Darton. [In colors.] Illustrate *Bull.* 387, "Structural Materials in parts of Oregon and Washington," Washington, 1909.

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, July, 1910.

Pilot Chart of the North Pacific Ocean, August, 1910.

U. S. WEATHER BUREAU CHARTS

Meteorological Chart of the North Atlantic Ocean, August, 1910.
Meteorological Chart of the North Pacific Ocean, August, 1910.

DEPARTMENT OF AGRICULTURE MAPS

UNITED STATES. Soil Survey Maps of Lamar Co., Ala.; Grady and Thomas Cos., Ga.; Camp and Overton Cos., Tex; Reconnoissance soil survey of south Texas. Scales, 1 inch=1 mile and 1 inch=6 miles. [In colors, with contours of elevation and descriptive text.]

CANADA. Pelly, Ross and Gravel Rivers, Yukon and North West Territories. 1:506,880=8 miles to an inch. 61° 15'-65° N.; 124°-133° W. Illustrates "A Reconnaissance across the Mackenzie Mts. on the Pelly, Ross and Gravel Rivers" by Joseph Keele. No. 1097, Can. Dep't. of Mines, Geol. Surv. Branch, Ottawa, 1910. [In colors with descriptive notes, topography along the rivers in black and geological detail in red lettering.]

CANADA. St. Bruno Mt., Quebec. 1:9,600=800 feet to an inch. By W. B. Boyd. (a) Topography; (b) Areal Geology. Illustrate "Geology of St. Bruno Mt., Quebec," by John A. Dresser, No. 1077, *Memoir* No. 7. Can. Dep't. of Mines, Geol. Surv. Branch, Ottawa, 1910.

AFRICA

TRANSVAAL COLONY. Geological Map of the Pilgrims Rest Gold Mining District. 1 inch=2.25 miles. 24° 25'-25° 15' S; 30° 15'- 30° 58' E. Illustrates "The Geology of the Pilgrims Rest Gold Mining District," by A. L. Hall. Transvaal Mines Dep't., Geol. Surv., Mem. No. 5, Pretoria, 1910. [Colors for geology and hydrography with relief features in dark tones. This district, after the Rand, is the most important goldfield of the Colony.]

ASIA

SIAM. (a) Map of Siam showing areas included in recent Surveys. 1:5,000,000=78.9 miles to an inch. [The Cadastral Survey, confined to a large area around Bangkok and a small area around Chantaburi is shown in brown; the Topographical Survey, in the northwestern and extreme southern parts of the kingdom, is in green. The mountain features throughout Siam are approximately shown in brown contours.] (b) Map showing area cadastrally surveyed, Oct. 1, 1907. 1:800,000=12.6 miles to an inch. 13°-15° 10' N.; 99°-102° E. [The area surveyed is distinguished from the area traversed for detail survey.] (c, d,) Maps of Krung Kao and Pachin Provinces showing progress of Cadastral Survey. 1:400,000=6.3 miles to an inch. (e) Index Plan, Ratburi Province, Traverse Survey. 1:400,000. (f) Index Map of Triangulation Survey, Island of Puket. 1:160,000=2.5 miles to an inch. (g) Index Plan showing progress of Bangkok City Survey, 1908. 1:50,000=0.7 miles to an inch. (h) Plan showing progress of Survey, Province of Pitsanulok. 1:900,000=14.2 miles to an inch. Plan showing progress of Survey, Province of Pa-Yap. 1:1,500,000=23.67 miles to an inch. *General Report* on the Operations of the Royal Survey Department of Siam, 1906-1907. Bangkok, 1909. [The Report and Maps are published in English.]

AUSTRALASIA AND OCEANIA

Papua-German New Guinea. Tracing to show the work done by the British Commissioner, Anglo-German Boundary Commission, January-July, 1909. 1 inch=4 miles. Illustrates "Papua: Report for the Year ended 30th June, 1909." [A black sketch showing Anglo-German boundary as delimited, with geographical features on both sides of it. The object was to fix the position of the 8th parallel of S. Lat. which, for some distance forms the boundary between German New Guinea and Papua. The work was begun in January, 1909, and was expected to be finished in October.]

EUROPE

France. (a) Schéma du Bassin des Dranses; (b) Bassin des Usses; (c) Bassin du Fier; (d) Bassin du Lac du Bourget; (e) Bassin du Guiers; (f) Bassin de la Bourbre; (g) Bassin de la Gère; (h) Bassin des Collières; (i) Bassin de la Galaure; (j) Bassin de la Drôme; (k) Bassins du Roubion et de la Barre; (l) Bassin du Lez; (m) Bassin de l'Eygues. 1:200,000=3.1 mile to an inch. Illustrate "Compte Rendu et Résultats des Études & Travaux au 31 Dec., 1907, Tome 3, Service d'Études des Grandes Forces Hydrauliques (Région des Alpes). Ministère de l'Agriculture, Paris, 1908. [Each principal basin with the component basins forming it is indicated; hydrography in blue, gauging and rain stations shown and also distribution of hydraulic power plants.]

France. Carte des Gisements de Coquilles comestibles de la Côte sud du Finistère comprise entre la Pointe Trévignon et la Pointe de Penmarc'h. 1:51,-500=0.81 mile to an inch. In colors. By J. Cuérin-Ganivet. Illustrates *Bull.* de l'Institut de Océan., No. 170, Monaco, 1910.

France. Carte des Gisements de Coquilles comestibles de la partie des côtes de l'Ille et Vilaine comprise entre le Cap Fréhel et la Pointe du Grouin. 1:46,-000=0.72 mile to an inch. Dressée par L. Joubin. In colors. Illustrates *Bull.* de l'Institut de Océan., No. 172, Monaco, 1910.

Italy. (a) Geologische Karte der Adamello-Gruppe. 1:75,000=1.18 mile to an inch. Aufgenommen 1888-1891, 1894-1896, 1898-1900, 1902, 1904 von Wilhelm Salomon. [25 symbols, nearly all colored, are used for geological formations, lakes, glaciers, and locations in which fossils were found. The colors and nomenclature are imposed upon a topographic base map, the relief forms being shown by hachuring and contrasts of light and shade. Many elevations are given in meters and, scattered over the map, are five devices for showing different angles of slope.] (b) Kärtchen der vom Verfasser begangenen Routen. 1:200,000=3.1 mile to an inch. [Routes in red.] Illustrate "Die Adamello-gruppe, ein alpines Zentralmassiv und seine Bedeutung für die Gebirgsbildung und unsere Kenntnis von dem Mechanismus der Intrusionen," by Wilhelm Salomon. *Abhandl.* der. k. k. Geologischen Reichsanstalt, Band 21, No. 1, Vienna, 1908. [These maps are fine specimens of the work of the renowned k. u. k. militär geographisches Institut of Vienna.]

Spain. (a) Anciennes Routes de Transhumance en Spain. 1:5,000,000=78.9 miles to an inch. (b) Voies ferrées servant à la Transhumance en Espagne au Début du xxe Siècle. 1:5,000,000. [Colored maps showing distribution of winter sheep pasturage in Spain and the old and new routes for transferring sheep from one grazing district to another.] (c and d) black maps, 1:12,500,000, showing distribution of sheep in Spain and the number of sheep transferred per 100 square

kilometers. Illustrate "La Transhumance en Espagne," by A. Fribourg. *Ann. de Géog.*, Vol. 19, No. 105, Paris, 1910.

OCEANS

North Atlantic. Atlantique Nord. 16°-58° N.; O°-82° W. Four black charts illustrating "Bouteilles, Glaces et Carcasses flottantes de 1887 à 1909, d'après les Pilot-Charts." By A. Hautreux. *Bull.* de l'Institut de Océan., No. 173, Monaco, 1910.

HISTORICAL GEOGRAPHY

Early New York. Five maps in portfolio. By Townsend MacCoun:

(*a*) 1609. The Island of Manhattan (Mannahtin) at the time of its discovery; showing its elevations, water-courses, marshes and shore line. Based upon the early colonial surveys of Ratzer, Montresor, Knypthausen, Bradford, Duyckinck, etc., and the Survey of 1867 by Gen. E. L. Viele.. Identified Indian nomenclature in red. Present streets and shore line for identification. 47 x 12 inches. New York, 1909.

(*b*) 1609. The Hudson River (Cahohatatea), at the time of its discovery by Henry Hudson. The Indian names are obtained from the Dutch Colonial Records; the deeds and patents of the Van Rensselaer, Schuyler, Livingston, Van Cortlandt and Philipse families. As the spelling of Indian names differs greatly the earlier forms have been generally adopted. 31.5 x 6.5 inches. New York, 1909.

(*c*) 1653-1664. Amsterdam in New Netherland. The City of the Dutch West India Company. The personal names are those of the more prominent citizens of that period with the location of their homes. The principal points of interest are in red. 20 x 13 inches. New York, 1909.

(*d*) 1730. New York, the English Colonial City. The principal points of interest for this period are in red. 20 x 13 inches. New York, 1909.

(*e*) 1783. Manhattan Island at the close of the Revolution. Showing the American City with its Landmarks and the Revolutionary Fortifications on the Island. Outline of the city as then laid out in streets, and roads leading north, are in red. 47 x 12 inches. New York, 1908.

[The author, who is well known for his contributions to historical geography, has performed a public service in compiling these careful and well executed maps. They are a very convenient and useful series with the aid of which one may take a cartographic short cut to a great deal of important geographical information relating to the early historical days of Manhattan Island and the Hudson river; and they will be equally serviceable to those who read the literature of the subject.

Perhaps the most interesting features of Map *a* are its delineation of the hydrography of Manhattan before it was captured and practically annihilated by civilization; and its graphic revelation of the filling in of the shore waters and the building out of the shore line for the purposes of the dockage system along the lower part of the island. On Map *b* a large number of the Indian names for tributaries of the Hudson, and other geographical features are given, from New York Bay to north of Albany. The three maps (*c*, *d* and *e*), showing the development of the colonial city in the Seventeenth and Eighteenth centuries are certainly superior in the care with which they have been compiled and the manner of presenting the material to many of their predecessors.]

ATLASES

Atlas général Vidal-Lablache. Histoire et Géographie. 420 Cartes et Cartons. Index alphabétique de 46,000 noms. Librairie Armand Colin, 1909. [As the parts of this excellent and standard atlas were reissued for the present revision of the work, the *Bulletin* called attention to the superior production of these maps, to the large number of small insets giving a great deal of information that cannot be included on the main maps, to the important attention that is given to the physical and economic aspects of all countries and to the explanatory text at the bottom of each sheet which helps the reader to make the maps useful in the highest degree. For a general household atlas, embracing historical as well as regional geography, this work has no superior for those who can read French.]

A School Economic Atlas. By J. G. Bartholomew LL.D. With Introduction by L. W. Lyde, M. A. 64 quarto pages of Maps and Diagrams. Clarendon Press Oxford, and American Branch, Clarendon Press, New York, 1910. [Several of the leading nations now have one or more economic atlases for use in the teaching of economic geography in the secondary schools. It would be expected that any work of this kind, produced by the leading cartographic house in the English speaking world, would be a superior work of this class; and an examination of it shows that this expectation is fully realized. It may be recommended to the schools or the general public of America as an admirable cartographic presentation of the economic interests of the world and of the physical and other influences that affect the distribution and quantity of production, manufactures and trade. The physical and climatic maps are of the greatest utility because they illustrate best the ordinary processes of geographical control. The maps following them, and dealing with the distribution of commercial products, become highly significant when used, as they are intended to be used, in close connection with the physical and climatic maps that lead up to them. No school economic atlas has been more consistently and effectively designed than this one to inculcate throughout the fundamental principles upon which the correct study of economic geography depends.

The first 13 plates are general world maps illustrating the broad features of geographical control and the economic importance of race, religion, etc. We may illustrate the plan of the maps of the continents by citing the series devoted to North America:

On pp. 40, 41 are eight maps of the continent giving the January and July isotherms, the January and July rainfall, outlining the orography in tints of blue for sea depths with white for the continental shelf and tints of green, yellow and brown for the land elevations; five tints each for the vegetation and density of population maps; a political map. P. 42 is an industrial map showing navigable rivers and principal railroads with tints for the distribution of agriculture, livestock, mining, fishing and the chief manufacturing districts, the nature of the leading industries also being indicated. P. 43 is an economic map of the United States and Canada giving this information in all the most important detail. This is the first school economic map on which we have seen petroleum included among the products of Illinois where, for several years, it has been an industry.

The maps are well produced and are easily read, which is not the case with some of the best German economic school maps.]

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THE LIBYAN OASIS OF KHARGA

BY

ELLSWORTH HUNTINGTON.

A hundred miles west of the Nile valley, in the latitude of Luxor, the barren plateau of Libya is broken by a string of depressions containing oases. Formerly they could be reached only by a slow camel-journey of four or five days across a scorching and well-nigh waterless stretch of verdureless upland, sometimes among sand dunes, but chiefly over broad expanses of rough limestone from 1,000 to 1,800 feet above the sea. To-day a railroad has been built and the journey can be made in a few hours. Among the oases perhaps the most interesting is that of Kharga, lying 400 miles south of the Mediterranean Sea. In approaching it over the dry plateau one suddenly finds himself at the top of a line of cliffs, from 600 to 1,000 feet high, running north and south. At their foot lies the oasis, a poor, desolate place, which yet seems fruitful because it is not utter desert.

Kharga is a depression about 115 miles long, from north to south and from 12 to 50 miles wide east and west. It is narrowest at the south, but toward the north it expands and sends off a branch to Dakhla, another oasis, lying 90 miles to the west. On the east and north sides of the Kharga depression, steep cliffs form a comparatively straight border; on the west and south, however, there is no definite border, and the land rises gently to the surrounding desert. The reason for the existence of cliffs to the north and east, but not to the south and west, is that the cretaceous and tertiary strata of which the country is composed dip toward the east and north. Dur-

ing the long process of erosion the softness of certain strata has allowed them to be worn back along the plane of the dip, leaving the underlying hard strata to form the floor of the depression, in most places, and causing the formation of cliffs where hard overlying strata have been undermined. No one knows exactly what has become of the material which has been removed in making the depression. Perhaps it has been blown away by the wind; or possibly at some former period streams flowed to the ocean, although at present the depression has no outlet and appears to be surrounded on every side by high land.

The floor of the depression of Kharga is a large, irregular plain from 100 to 400 feet above the sea. It is broken here and there by isolated mesas, flat-topped remnants of the limestone which forms the cliffs. It is also diversified by occasional long bands of sand a mile or two wide, having a trend from north-northwest to south-southeast, at right angles to the prevailing trade-winds which pile the sand into dunes. Somewhat to the east of the center of the depression lies a string of oases and villages extending about 75 miles north and south and divided into a northern group, with Kharga as its center, and a southern group centering around Beris. The villages are poverty-stricken places with flat-roofed houses of adobe, built low and close together. The narrow, crooked streets often run beneath thick arched roofs of mud, built apparently to furnish protection from the intense heat of the summer sun. Around the villages, palm orchards and gardens are carefully irrigated by means of 200 or 300 artesian wells. The rest of the floor of the depression is diversified by patches of tamarisks or reeds in the swampy areas due to the surplus water of the wells, or by drier tracts sparsely clothed with the prickly acacia tree, and the wild Doum palm notable for peculiar branching trunks.

Although the depression of Kharga probably has an area of 25,000 or 30,000 square miles, the population, which is of Arabic origin, amounts to only about 8,500. The number of inhabitants depends entirely upon the supply of water available for irrigation. All the water is derived from artesian wells, for which Kharga has been noted from time immemorial. Some wells which still flow strongly are supposed to have existed for 2,000 or 3,000 years; others of ancient date have dried up; while many flow but feebly. During the last fifty years several score of new wells have been dug, and considerable areas have been added to the districts where cultivation is possible, but the major part of the water supply still comes from wells

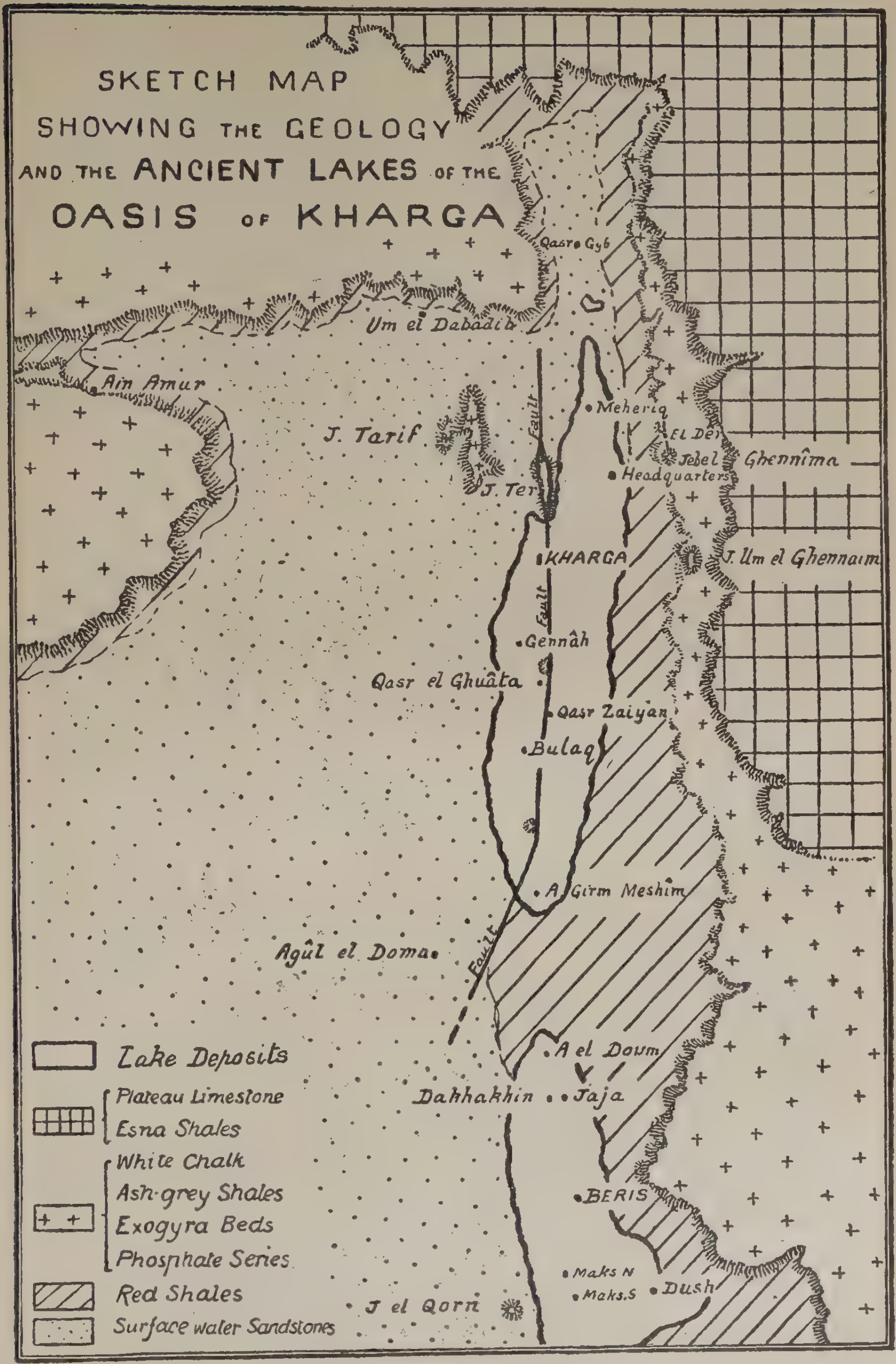

FIG. I.

From "An Egyptian Oasis."

dug as long ago as the Roman or Byzantine period, in the early centuries of the Christian era. In the whole oasis of Kharga there does not appear to be a single natural source of water—nothing but artesian wells. It is not known exactly where the water comes from. Its immediate source is the so-called artesian sandstone which lies at an average depth of about 125 feet. Far away in the swampy regions of the upper Nile this sandstone comes to the surface, and it is supposed that the water of the Nile River sinks into the sandstone and percolates slowly through it, reaching the surface only when artificial wells are pierced in the overlying layer of impervious limestone. In addition to the main artesian sandstone, there is an upper stratum of the same type in which also artesian wells can be sunk. This comes to the surface in certain places and in it water can be obtained by digging to slight depths. Oftentimes, however, the water is saline and not good for irrigation.

The preceding description of Kharga is drawn from a book recently published by Mr. Beadnell of the Egyptian Geological Survey, and entitled "An Egyptian Oasis." The book is noteworthy as a consistent and scientific description of a region of unusual interest. It is truly geographical in distinction from the many so-called geographical books which are mere accounts of travel and of personal adventures. Mr. Beadnell knows Kharga better than does any other living man, and his volume is crowded with facts which are absolutely reliable. So clearly and carefully are they stated that the reader is able to draw his own conclusions, some of which may differ from, or be additional to, those of the author.

The purpose of the present article is to take the facts furnished by Mr. Beadnell and to see what they indicate as to the climatic conditions of the Libyan desert in the historic past. He makes no reference whatever to the subject except to say that in pre-historic times the climate must have been much moister than at present. Apparently, he has not considered the matter, or else accepts as final the statement of certain members of the Meteorological Department of Egypt to the effect that the Nile Valley has suffered no change in climate during historic times. This is not the place to discuss the water supply of Egypt, which depends upon the climate of the equatorial regions far to the south. It must be borne in mind, however, that the climate of equatorial regions may be subject to variations very different from those of sub-tropical countries like Egypt, or it may remain uniform while that of climatic belts farther to the north undergoes marked variations. Kharga and the rest of

the deserts of northern Africa must be examined upon their own merits.

The importance of the question of changes of climate is evident from the number of articles which have appeared on the subject during the past five years. Its present status may be judged from the recently published work of various authors. For instance, among Europeans, Woiekof, a Russian who has made extensive studies of the fluctuations of the Sea of Aral and of other Asiatic lakes, is strongly of the opinion that there is no evidence of any important change during the last 3,000 years. All the facts appear to him to point merely to changes which have a period of, at most, a few decades and which have never departed far from the mean conditions of the past century. On the other hand, Hann, the greatest living authority upon climate, comes to quite a different conclusion. In the second edition of his great work upon climate, published in 1897, he discussed periodic variations of climate, such as the 35-year cycles of Bruckner, but came to no conclusion as to climatic variations of longer periods. In his last edition, published in 1908, he says that in view of recent studies in central Asia, "we can scarcely doubt any longer that we have in these districts a general dessication which is still in progress." He goes on to say, "How far in all these accounts we have to do with a progressive dessication and how far with climatic oscillation, is still uncertain." Holdich, one of the foremost English authorities upon central Asia, says that no one will dispute the evidence of dessication, but he can "see at present no evidence" of great oscillations. In America, Ward, Abbe, and other meteorologists agree with Woiekof that the only changes in climate during historic times are those of short period and small amplitude. Bowman, and Moreno, on the other hand, have shown that in South America there is strong evidence indicating that during long periods since the occupation of that country by man the climate has been distinctly moister than during the past century.

Few places offer better opportunities than Kharga for testing the various theories as to climatic changes. The first stage in the recent climatic history of the oasis appears to be recorded in the so-called lake deposits described by Beadnell. They occupy the greater part of an area some 85 miles long and five to ten miles wide at the foot of the cliffs which bound the oasis on the east. Beadnell describes them as consisting "of horizontal, finely-bedded alternations of sand and clay, or more frequently of an intimate mixture of the two; local false-bedding is not uncommon, and included fragments

of limestone and sandstone are occasionally met with. The beds have a prevailing brown tint and frequently exhibit well-marked hexagonally disposed shrinkage cracks. Although originally they must have formed an immense, compact and continuous sheet, the deposits have since been subjected to considerable denudation, so that at the present day they exist as large isolated patches" (p. 111). Among the deposits some fragments of pottery were found firmly embedded in clay and also fresh-water shells of *Melania* and *Limnaea*.

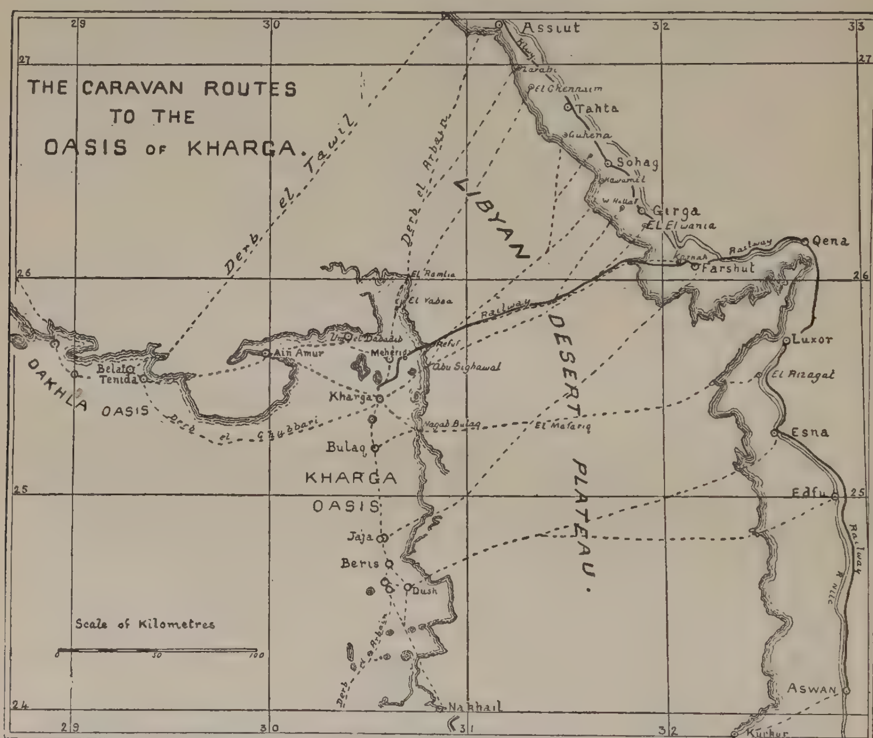

FIG. 2.
From "An Egyptian Oasis."

The upper portion of the clays lies at an altitude which varies from 66 to 83 meters above sea level. Beadnell concludes that "while the lake presumably at one time reached to a maximum level of 85 meters, it stood for a considerable period at about 70 meters above sea level" (p. 116). He believes "that the depression was inhabited previous to the formation of the lake" (p. 116). "The evidence [of this] is . . . . the discovery of a portion of an earthenware

pipe imbedded *in situ* in the lake clays at a height of 42.85 meters, of the type used by the ancients for lining their water channels" (p. 120).

In explanation of the supposed lake or lakes in which these deposits were laid down, Beadnell suggests two hypotheses. The first is that when artesian wells were first bored, the water-bearing sandstones were so highly charged with water that the wells overflowed in great volume and formed lakes. The second hypothesis is a modification of the first. It supposes that the lakes were formed when the process of natural erosion first exposed the upper artesian sandstone and thereby allowed water to escape. Neither hypothesis is satisfactory. As Beadnell points out, the flow from a new well is at first rapid, but soon shows a marked decline, and finally settles down to a fairly steady flow, or to a flow which decreases at a constantly diminishing rate. If the discharge from the wells first drilled had been so great as completely to flood the immediately surrounding area, it is scarcely to be supposed that other wells would at once have been constructed. A single well or a dozen wells could not possibly have supplied water sufficient to balance the evaporation of a lake 85 miles long and from five to ten miles wide unless the head of water were scores or hundreds of times as great as it is to-day. The proof of this is found in the fact that the water of the 300 wells, more or less, now in operation, is evaporated from an area not a tithe as great as that of the supposed old lake. Let us assume that as many as twenty wells were dug at the very beginning, and that the evaporation from the surface was four feet per year, which is less than from the Salton Sea under climatic conditions similar to those of Libya. In order to maintain the lake at a constant level, each well would have had to discharge 240 times as much water as the average well of to-day. This would require a tremendous head of water. There is no reason to believe that the head in early days was much greater than at present; for at the depth where the artesian sandstone lies, all rocks in practically all parts of the world are saturated with water. They were saturated in early days and they are saturated to-day, except in the areas immediately surrounding the wells. Under conditions of complete saturation the head of water both in the past and in the present depends in part upon the height at which the water enters the rock and in part upon the amount of pressure exerted by the over-lying strata. These factors must have been essentially the same in the past as in the present.

As to the formation of the lakes according to the second hypothesis, it is sufficient to note one insuperable objection. When natural erosion first exposed the upper artesian sandstones, the topography must have been quite different from that of to-day, for at present the sandstones are exposed for many miles. The lake deposits, however, so far as can be judged, were laid down upon a topography very similar to that now prevailing.

It seems probable that only part of the deposits under discussion were formed in lakes. The nature of terrigenous as opposed to marine deposits, and of subaerial as opposed to lacustrine deposits has only recently been made clear by such men as Davis and others. Barrell has discussed the matter fully,* and has shown that the presence of shrinkage cracks, such as those described above, is a sure indication of subærial rather than lacustrine deposition. The other characteristics of the deposits, such as finely bedded alternations of sand and clay and local false-bedding are also more likely to occur in subærial than in lacustrine strata. Moreover the finding of fresh water shells, such as *Limnaea,* is not consonant with the existence of a lake. If a lake existed here, it is safe to say that it must have been salt, because, in the first place, it would have had no outlet unless it rose higher than the limit of 85 meters indicated by the upper deposits; and, in the second place, it must have existed a long time,—long enough to lay down sediments which appear to have a thickness of a hundred feet. If it had been salt, fresh water shellfish could not have inhabited it. Finally, the finding in the lake deposits not only of pottery at various levels, sometimes 40 meters below the upper deposits, but also of Neolithic flints which appear to have come from the middle clays, indicates that at various periods man lived upon the very areas where deposition took place. Altogether, the facts seem to indicate that a considerable portion of the deposits was laid down on the alluvial fans of streams flowing in from the surrounding plateau, or else in playas and swamps. If a lake actually existed, as seems highly probable, it was quite small at the time when the subærial deposits were laid down. At other times, however, during periods of relatively heavy rainfall, it may have expanded greatly. Such an expansion may account for the fact that Paleolithic implements are found only on the edges of the depression. Before Neolithic man appeared the lake may have contracted so that a part of the floor of the depression became habitable. Still later the water may have risen again, which may

* *Journ. of Geol.*, Vol. 14, pp. 524 ff., 568 ff.

account for the fact that the Neolithic flints are deeply buried. Finally the lake may have retreated once more during the Græco-Roman period in accordance with the conclusion of Beadnell quoted on a later page. In the absence of a series of exact sections showing the succession of beds in the mingled lacustrine and subærial deposits, it is impossible to come to any exact conclusion in the matter. The suggestions here made, however, show that further study of Kharga may give us a full record of climatic pulsations from Paleolithic times to the present.

Whatever may have been the size of the lake, whether large or small, and whatever may be the proportion of alluvial deposits, the facts point clearly to climatic conditions different from those now existing. At present alluvial deposition is not taking place, but on the contrary, erosion is in progress. The nearest approach to lakes is now a few small swamps. If the rainfall of past times were such as to cause streams of sufficient size to flow down from the plateau during the winter, the conditions of both alluvial and lacustrine deposition would prevail. Evidently, some such conditions prevailed during the time when the flints and pottery were deposited. We cannot date the flints, but, as Beadnell says: (p. 118) "The types [of pottery] do not differ in any important respect from those associated with the towns and cemeteries of Græco-Roman age in many parts of the oasis. . . . The pottery, therefore, bears out our conclusions that the lake continued to exist well into the historic period." While there is room for question as to the nature of the deposits in which the pottery is found, we can scarcely question that the climatic conditions which made their deposition possible did continue into the historic period.

In connection with the existence of an ancient lake or of streams which formed large deposits, some notice should be taken of the springs of Kharga. At the present time, as Beadnell tells us, there is no natural efflux of water anywhere in the depression. On the border, however, there are one or two small springs such as Ain Amur, which once supported small settlements, but are now mere water holes. In ancient times the case was different. "The existence of thick deposits of calcareous tufa on the upper portions of the cliffs of the depression suggests a considerable outpouring of water from springs" (p. 112). It is safe to assume that there must have been springs on the floor of the oasis also. We can scarcely suppose that the first drillers of wells were so far advanced in science and art that they sunk wells at points where there was no

flow of water. Moreover, if there were springs high up near the top of the cliffs there must have been others lower down. The reason why there is to-day no natural efflux of water in the oasis proper is probably that all the natural sources were early converted into artesian wells. It is interesting to note that all the ancient wells are called *Ain,* which means in Arabic *spring,* while those of modern construction are called *Bir,* which is the common word for *well.* The explanation of this nomenclature may be that the original wells were built where springs were located, but it is equally possible that when the Arabs came to Kharga they found numerous flowing wells and called them springs, not realizing that they were artificial.

The earliest settlers in Kharga certainly did not use artesian wells. Neither palæolithic nor neolithic man was sufficiently skilled to make use of subterranean sources of water. Devoid of all iron tools, as these early people were, they cannot possibly have dug into the solid rock. Their wells must have been mere shallow holes in the soft sand or clay. Nevertheless, primitive man lived in large numbers in Kharga, as is proved by an abundance of flint implements. The palæolithic implements are found chiefly on the edges of the oasis and upon the surrounding plateau, which, as has already been said, suggests that in the earliest days of man the center of the oasis was a lake or swamp, and hence uninhabitable. It suggests also that regions outside the oasis,—districts which are now absolute desert—were then habitable. It is probable that palæolithic man drank from springs which now have disappeared, but whose deposits of tufa still lie upon the upper cliffs.

Turning now to the vicissitudes of Kharga during strictly historic times, we find that in the past the population was much more dense than it is now. A few quotations from Beadnell will show his opinion upon the matter.

"One frequently hears it stated that the oases were far more thickly populated and better watered in olden times than at the present day. This belief is based on the existence in many parts of the depression of extensive remains of temples, forts, and villages, on the widespread traces of formerly cultivated lands, and on the abundance of sanded-up wells. It must not, however, be forgotten that the remains in question belong to successive generations, and that there is as yet no evidence to enable us to determine how much of the land, or how many of the wells, were in use at one and the same time. The evidence is, however, sufficiently pronounced

to justify the conclusion that under the Romans the oasis of Kharga was far more flourishing than in modern times, a large part of the population being engaged, not in agriculture but in mining, boring, and in the excavation of subterranean aqueducts" (pp. 156-157) . . . "The inhabitants [at the present day, as apparently in the past also] rely almost entirely for subsistence on the products they are able to raise by their own toil and industry. Owing to there being no rainfall, the acreage of land which can be put under crops depends absolutely on the amount of water available for irrigation by wells. The total yield of the latter has, we know, fluctuated to a considerable extent at different times, and one may surmise that, could figures be obtained giving the number of inhabitants and the volume of the water-supply for different periods during the last 5,000 years, a remarkably constant ratio would be observable between the two" (pp. 62-63).

Abundant ruins in places not now occupied and numerous old canals leading from wells now dry support the statements quoted above. It may be true, as Beadnell says, that in Roman days a large part of the population were engaged in "mining, boring, and the excavation of subterranean aqueducts," but, in order to support these artisans and give them work, there must certainly have been a much larger number of people who were engaged in agriculture. If this were so, the agricultural population, and hence the supply of water must evidently have been much greater than at present. In the old days the number of wells was probably not much in excess of that of to-day, for although many have dried up, a large number of others have been bored during the last 50 or 60 years. The ancient wells were not so deep as the modern ones, which is, perhaps, one reason why the modern wells discharge water although many old shafts have run dry or give only a little. Beadnell mentions many instances of ruins where no villages now exist and of land which has gone out of cultivation. For instance, in referring to Maks Kibli, in the southern part of the oasis, he says: "Here as elsewhere in this part of the country much land has gone out of cultivation, though it must be mentioned that the villagers are rather progressive in planting trees and maintaining small vegetable gardens." Farther south he mentions a well, Ain Mabruka, which "just trickles and irrigates a tiny area of not more than a few square meters. This is the most southerly point at which exposed water is to be seen, though in the midst of a large area of scrub still farther south a sanded-up well by the name of Ain El Terfai is

reported to exist" (p. 85). Another place where the flow of water must have seriously diminished, is Dakhakhin. "The ancient Dakhakhin must have been as ugly as the modern village is pleasant . . . . the ruins are only slightly above the level of the plain, but cover an area many times greater than that occupied by the modern village. This circumstance alone shows how insignificant is the present flow compared with what it must once have been" (p. 80). Again, "At Ain Bella . . . . there are at present only a few acres under cultivation, but the tract anciently tilled is seen in the eroded remains of an alluvial platform to the northeast. This is now a deeply grooved and ridged hummocky area of loam full of dead palm stubs with rootlets ramifying in every direction. The original terrace [that is, cultivated alluvial platform] appears to have extended far to the north. . . . At one time or another many wells existed to the west but are now buried in the dunes, their former presence being testified by isolated exposures of arable land, and by occasional trees and bushes. The dunes following their natural S.S.E. course in the direction of the prevailing winds, seem to be still encroaching on the belt of country occupied by the existing wells and cultivated lands, and it is probably only a matter of time, perhaps a few hundred years, before they blot out the whole of the south part of the oasis. The sand speedily envelops any settlements which are abandoned, as nothing encourages the formation of dunes to such an extent as vegetation, and this nearly always abounds in the neighborhood of the wells" (pp. 83-4).

Facts such as these and many others show unquestionably that the area under cultivation has greatly diminished during historic times. They show further that at present the encroachment of sand is a very serious matter. The statement that nothing encourages the formation of dunes to such an extent as vegetation is only partially true. In Chinese Turkestan the writer observed again and again that dunes of great size grow up upon the edge of an area of vegetation, but do not penetrate very far into it. In the same regions it was also noticeable that wherever vegetation had died, there the sand began to move. If the climatic conditions of a country remain stable for any length of time, the dunes of interior regions away from the seashore advance only until a certain point of equilibrium is reached. Thereafter the sand encroaches not at all or only at an imperceptible and constantly diminishing rate. The fact that dunes are now advancing upon cultivated regions

shows that in relatively recent times there must have been some change in the conditions of vegetation.

Another point which indicates that present conditions are different from those of the past is the roads leading out from the oasis. One such road once ran from Kharga westward 500 miles to Kufra, passing to the south of a great area of sand dunes. "It is probable." says Beadnell, "that within the last century the area of this sand has extended considerably to the south, as an old caravan road trending westwards and believed originally to have connected the oases of Dakhakhin and Kufra is now lost in the dunes" (p. 4). In the same way, from the spring and ruins of Ain Amur, "very old tracks trending in a westerly and northwesterly direction are noticeable, and although unused at the present day these may mark the presence of former frequented routes leading to the oasis of Farafra. At the present time that oasis is not in direct communication with Kharga, the routes used being from Manfalut in the Nile Valley, from Qasr Dakl in the oasis of Wakhla and from Ain el Hais in Baharia" (p. 38). These two abandoned roads have not been carefully investigated, but what is known of them suggests that at the present time the Libyan desert is much more difficult to traverse than in the past. A similar suggestion is given by the water stations along the old Roman roads which connected Kharga with the Nile valley. One such is found in El Tundaba, a deep shaft sunk in a hollow full of silt in the plateau half way from the Nile to the oasis (p. 29). The shaft and the hollow are now quite dry, but flints, pottery and graves indicate that the place was once the site of a settlement. It cannot be inhabited to-day, and the chances are that it could not have been inhabited in the past, if present conditions had then prevailed.

The last line of evidence as to the ancient water supply is found in a number of tunnels at Quasr Lebekha, Quasr Gyb, and especially Um el Dabadib, in the northern part of the Kharga depression. They are dug in the upper artesian sandstone. At the latter place there are in all four main tunnels varying in length from two to four miles. One of the tunnels has recently been thoroughly cleared out and is now in use, so that it is possible to estimate the relation between the amount of labor involved and the results obtained. The tunnel is "distinctly coffin shaped in cross section, being widest near the roof and tapering downwards" (p. 174). It measures roughly five by two feet. The tunnel is reached by vertical shafts about

five by two and one-half feet in size and varying in depth from a few feet near the mouth of the tunnel to 175 feet at the inner end. The shafts number 180 and are placed at intervals of about 65 feet on an average. The length of the main tunnel is 1.8 miles. The amount of vertical excavation for the shafts amounts to over two miles. Various branches and curves add somewhat to the length, so that the total excavation was fully four miles. Beadnell is impressed by the amount of labor in proportion to the results obtained. He says, "Although it is difficult to believe that the supplies of water obtained were commensurate with the time and labor involved in the construction of the collecting tunnels, we may safely assume that the engineers who so carefully planned and carried out the works had fully considered the results to be looked for. The ruins of villages and the traces of formerly cultivated tracts show that sufficient water was obtained to enable fairly large colonies to exist, though after the withdrawal of the Romans these outlying districts were abandoned, the aqueducts silted up, and the cultivated lands reverted to the desert" (pp. 170-171).

The tunnel, as we have said, was cleaned out a few years ago, and "water again flowed from the mouth of the aqueduct and enabled a small agricultural colony to establish itself on the site of the original founders" (p. 171). The tunnel is now in excellent repair, as Beadnell found upon traversing it to the upper end. In January, 1905, the discharge "from the mouth of the aqueduct was between thirty and thirty-five gallons per minute; a dozen acres or so of land had been reclaimed and were tended by seven or eight men, who informed me that the crops reaped there were equal to those in any part of the oasis" (p. 172).

A careful examination of the facts stated above shows that whereas in Roman times these tunnels enabled "fairly large colonies to exist," the tunnel which has now been re-excavated serves only to irrigate "a dozen acres or so of land." In other words, if the conditions of the past were like those of the present, "the engineers who so carefully planned and carried out the works" thought it worth while to excavate a tunnel about 1,800 feet long for every acre of land to be irrigated. The average well in Kharga, including old and new, good and bad, yields about 35 gallons of water per minute, which, as we have seen, is equal to the present discharge of water from the tunnel. The depth of a well varies from 125 to 800 feet. Wells of the latter depth were certainly rare in ancient times, and there is no reliable evidence that any were so deep. The average

well does not seem to have been over 250 feet deep. Assuming still that past conditions were like those of the present, we must conclude that the Roman engineers, in order to secure an amount of water equivalent to that from an average well, went to the labor of excavating tunnels and shafts four miles in length and with a size of five by two feet. In constructing an ordinary well the first process is to dig a hole about 100 feet deep and six feet square which would require the excavation of nearly 150 cubic yards of rock. Then a shaft perhaps 8 inches in diameter is drilled for the remaining 150 feet. The latter process is difficult, but, nevertheless, wells were drilled by the hundred in ancient times. Compare with this the labor of building a tunnel and shafts to a length of four miles. The total amount of excavation involved in building the single tunnel which has been opened is estimated by Beadnell at 4,875 cubic meters or 5,850 cubic yards. Such work was more difficult than the excavation of a large open well like that which under native methods was constructed as the first stage in boring a well; for the space where work was carried on was cramped, only one person could work at a time, and all the excavated material had to be carried to the shafts and hauled up, sometimes as far as 175 feet. To put the matter concisely the digging of a well involved the excavation of about 150 cubic yards of material, and the boring of a hole less than a foot in diameter and 150 feet deep. The excavation of a tunnel, on the other hand, involved the excavation of 5,850 cubic yards. In other words, if we deduct the excavation of 150 cubic yards of material from the labor involved in each case, we find that in order to get a yield of about 35 gallons per minute the driller of the well had to bore a hole only 150 feet deep, whereas the makers of the tunnel had to excavate 5,700 cubic yards of sold rock, digging a tunnel and shafts to the length of four miles.

The following quotation from Beadnell shows with what skill the Roman engineers carried on their work: "That the tunnel was most carefully planned and excavated is evident from its very low and gradual slope, as is indicated by the depth of water flowing through and by the generally unrippled character of the stream. Judging by the height of the mouth of one of the man-holes near the point of origin of the tunnel, and by its depth to the stream in the tunnel below, there only appears to be a fall of one meter in about 2½ kilometers, or a slope of 1 in 2,670" (p. 178).

There can be no question that the ancient engineers were skilled in their art. It is evident that such men would never have dug tun-

nels if, by scarcely one-hundredth as much labor, they could have drilled wells capable of supplying an equal amount of water. It may be thought that perhaps when the tunnel was first dug the yield of water was exceptionally large because new areas of rock were being continually opened. There may be some truth in this, but inasmuch as only one man could work in the tunnel at a time, and inasmuch as shafts had to be dug from above before excavation could go on, the progress of the tunnel must have been so slow that the effect of the opening of new rock must have been slight. By the time the work had paused long enough to allow a shaft to be sunk from above, the tunnel could scarcely have produced a flow much in excess of that which continued permanently. The upper artesian sandstone in which the tunnels were dug is exposed at the base of the cliffs bordering the oasis. Hence both before and after the construction of the tunnels it was subject to natural drainage through springs. Therefore, it contained no stored up supply of water like that found in the other sandstone, far below the surface. The only reasonable supposition seems to be that when the Romans built these great irrigation works, the sandstone contained a much larger supply of water than at present. Such a supply of water can have come only from increased rainfall.

We have now seen that there is close agreement among many lines of evidence such as lacustrine or alluvial deposits, ancient spring deposits, ruins, ancient areas of cultivation, diminishing wells, roads in the desert, and tunnels where now no tunnels would be built. All these varied phenomena are explicable if we suppose that the average climate for many centuries in the past was distinctly moister than the average climate of to-day. Let us now see whether there is any evidence to show how the change from the past to the present took place. Was it a steady decrease in rainfall or did occasional periods of exceptional aridity alternate with moister epochs?

In prehistoric times human occupation of the country around Kharga seems to have been more extensive than at any succeeding period. During the palæolithic stage of development men occupied not only the floor of the Kharga depression but also the surrounding plateau; in the neolithic stage the area of occupation had decreased and the population was apparently most dense on the border of the depression near the foot of the cliffs. The center perhaps was occupied by lakes or swamps. Coming down to historic times we have records which tell us that Egyptian kings claimed allegiance of

the inhabitants of the oasis as far back as the 18th dynasty, 1545-1250 B. C. In Kharga itself the oldest ruins are those which belong to the time of Darius, about 500 B. C. At that time the Persians cultivated the oasis and built various temples, among which the temple of Hibis is still standing. This must have been a period of great prosperity, but our information in regard to it is very slight. Other ruins date from the time of the Ptolemies, and still more from the Roman period, beginning about fifty years before Christ, and lasting until A. D. 395. During the latter part of the Roman period the oasis was perhaps less prosperous than before or afterward; for there was much less activity in architecture than there had been in early Roman days or than there was during the Byzantine era which immediately succeeded it.

In regard to the location of ruins Beadnell makes an interesting statement. "In the first place," he says, "they are mostly on or near the extreme margin of the lacustrine deposits; secondly, they are absent altogether from the central portion of the lake site; and thirdly, the older monuments occupy the highest levels, while there are no representatives at all of the earlier Egyptian periods. While the disposition of the monuments may, of course, be entirely fortuitous, we are justified, I think, in assuming that the lake existed well into the historic period, and may have still stood at the 65 or 70 meter level when the temple of Hibis was erected by Darius, about 500 years before the commencement of the Christian era. In the time of the Ptolemies, it was certainly considerably lower, while in still later days, when the country became a Roman province, the lake had very much contracted, and probably only existed as a marshy swamp occupying the lower portions of the depression" (pp. 117-118). It is worth noting that during this period when according to Beadnell the lake was steadily decreasing in size, there was a great development of irrigation works. To quote from our authority once more:

"It was during the sway of the Roman Emperors that the Egyptian oases attained their maximum importance. During this period from 30 B. C. to about the beginning of the seventh century, extensive towns existed in Kharga, and the oasis was strongly garrisoned and protected by forts. Temples and other edifices were erected, while a great development of the water-supply took place. During the same period the oases were used as places of banishment, just as they were in earlier days under the Pharaohs, and have been, in a way, in quite modern times. Juvenal, the Latin satirist, was ban-

ished to Syene at the beginning of the second century, as a punishment for his attacks on the Court, and he appears also to have been for a time confined in Kharga; Athanasius, Nestorius, and other celebrities likewise made unwilling acquaintance with this portion of the Empire. Sayce remarks that the oases under the Romans were thoroughly cultivated, a brisk trade in wine being carried on, and mentions that on one of the temple walls there are several inscriptions which lead one to infer that Kharga yielded a considerable revenue . . . . . . (p. 94).

"Although the Persians and Romans left abundant traces of their occupation of the country in the shape of temples, forts, and monasteries, the determination and energy with which they prosecuted the colonization and general development of the oases is best shown by their attention to works of public utility. At no period in the history of the oases has so much attention been paid to the water-supply. Not content with tapping the deep-seated sources by means of bores, they carried out underground works of considerable magnitude and involving engineering difficulties of no mean order, so as to obtain additional supplies from the sandstones lying at or near the surface. The methods employed were probably introduced from Persia, where underground aqueducts, or 'kareez' for the transference of water from one locality to another, have from an early date been employed. At the same time, judging by the character of the ancient buildings in the immediate neighbourhood of the most important of these works, it seems probable that the latter were for the most part constructed by the Romans" (pp. 167-8).

These long quotations have been inserted because of the significant fact that irrigation works were developed at just the time when the lakes were drying up, or when the streams which supplied the alluvial deposits were diminishing. Apparently, this great activity in digging wells was due to the fact that during the period immediately after the time of Christ especial need was felt for a larger supply of water.

Before leaving the ancient history of Kharga, another fact deserves to be recorded. In those days Kharga and the oasis of Dakhla, 75 miles further west, were included under the common name "The Great Oasis." To-day they are distinctly two oases separated by many miles of desert. They would scarcely have been called one oasis unless they had had a closer connection than that of to-day. Such a closer connection would only have been possible if the intervening country were moist enough to be inhabited.

The further history of Kharga may best be described by quoting once more: "With the withdrawal of the Roman garrisons and the Mohammedan conquest decay set in, and, as Sayce remarks, the aqueducts became choked, the fields were neglected, and malarial fever invaded a district which had at one time been regarded as a health resort.

"Of the history of the oases during the succeeding seven or eight centuries no records are available, but, judging from the writings of Arabian geographers, between the eleventh and the fifteenth centuries, it is evident that they gradually became depopulated, and were regarded as of little importance. El Sherif el Edrissi, writing about the middle of the sixth century of the Hegira (1150 A. D.), refers to the oases (Al Vahat) as places formerly containing streams of water, with lands on which trees were still found growing, and with ruined, uninhabited towns. He adds that the goats and sheep had become quite wild, and were trapped by hunters like other wild animals" (p. 108). Beadnell is inclined to believe that Edrissi's statement cannot refer to Kharga proper, but to some outlying region. "It seems" he says "extremely unlikely . . . that the Great Oasis as a whole had become entirely uninhabited." To the writer of the present article this does not seem at all unlikely. As he has shown elsewhere, the twelfth century appears to have been a period of extraordinary aridity, second only to that of the seventh century, and aridity would inevitably cause depopulation in Kharga.

Yakut, an Arabian historian, writing about 1225 A. D., speaks of three oases in this region and refers to the first of them as being well cultivated, containing streams and hot springs, palms and cultivated lands. His description suggests that Kharga was more prosperous in his day than it had been three quarters of a century before in the times of Edrissi. Ismail Abulfida, writing about 1300 A. D., speaks in still better terms of the oasis, which in his day abounded with palms and running water. Since that time we have practically no information until about a century ago.

The various phases through which the history of Kharga has passed may now be summed up and compared with the climatic vicissitudes of the country. Up to the time of Christ and on until the third century of our era the fortunes of Kharga were relatively high. Toward the end of the Roman period they declined somewhat, but rose again during the Byzantine period, from the fourth to the sixth century. Then in the seventh century they fell to a most deplorable condition. During the years that followed we have no

information as to the fate of the oasis till the days of Edrissi in the twelfth century. Then, again, if the Arab writer is to be believed, Kharga was in a state worse by far than to-day. Soon, however, she rose once more, and at the beginning of the fourteenth century enjoyed a certain degree of prosperity. Since that time there may have been a little falling off, although here again our information is scanty. In regard to the water-supply, all the evidence points to a decrease since the time of the Persians. Apparently, this had no great effect until the time of Christ or afterward. Even at that time, if our conclusions are correct, it was not particularly harmful, because the decrease in the natural supply induced the people to provide an artificial supply, and thus, perhaps, stimulated rather than hindered industry and civilization. Between the period of decay toward the end of the third century, when the power of Rome was waning, and the brilliant Byzantine period some two hundred years later, we have, in Kharga itself, no evidence of any change of climate. Nevertheless, if Beadnell's repeated statement as to the close relation between density of population and prosperity, on the one hand, and water-supply, on the other, is true, the Byzantine period was probably somewhat moister than the latter part of the Roman period. Judging from the extreme depopulation in the seventh century the early Mohammedan days must have been a time of great aridity, although the general commotion which then took place in western Asia and northern Africa makes it impossible to draw any positive conclusions from Kharga alone. During the succeeding five centuries we have no definite information as to Kharga, but in the twelfth century we find it again almost depopulated, a condition which suggests but does not prove great aridity. In the next two centuries there seems to have been an improvement in the habitability of the oasis. How that time compared with the present it is impossible to tell.

A comparison of the history of Kharga with the climatic pulsations of which evidence is found in Central and Western Asia is highly instructive. The pulsations are represented in the accompanying curve (Fig. 3), which is taken from the author's volume "The Pulse of Asia," but has been modified somewhat to make it conform to new data obtained during the Yale Expedition of 1909 to Palestine. Horizontal distance represents time, and vertical distance the amount of rainfall. Thus the curve is high during moist periods and low when the climate is dry. The curve is based upon a large body of facts as to the abandonment of ruins, the giving up of old roads because of lack of water, the fluctuations of enclosed

lakes, and the disappearance of springs and other sources of water. It will be seen that it agrees exactly with our inferences in regard to Kharga. So far as our information goes, the Libyan oasis has prospered and had a large supply of water at exactly the times when the climate of western and central Asia has been comparatively rainy. Its supply of water has decreased and its population has diminished

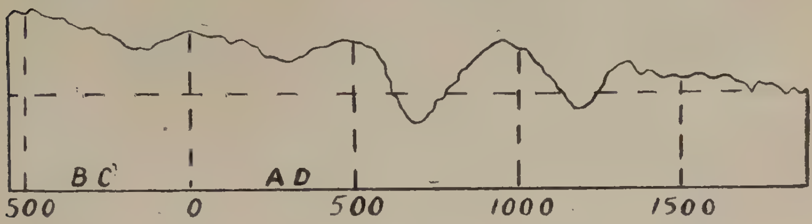

Fig. 3.

coincidently with similar events in Asia. So close an agreement among the phenomena of regions extending from Lybia through Arabia, Persia and Turkestan to the far confines of China, would scarcely be found unless the whole area had been subjected to a uniform series of important climatic pulsations.

THE ISLAND OF SÃO THOMÉ.

It is believed that no tropical country to-day possesses, for so small an area, a degree of economic prosperity that is comparable with that of the Portuguese province of São Thomé and Principe. They have advanced, in a few years, to the first place among the cacao producing countries, wresting the primacy from Ecuador, which had long held the first place. In 1905, their production was 23,187 tons, while that of Ecuador was 18,268 tons. The new development of agriculture in São Thomé dates only from 1870, but in 1904 it was exporting annually over $6,000,000 of cacao and coffee. Perhaps, in our day, there has been no agricultural development comparable with this, in so short a time and with so little capital and so small a force of toilers.

For some years past Mr. Aug. Chevalier has been in the service of the French Government studying the agricultural possibilities in the chief African colonies and looking for favorable places at high

altitudes that may serve as sanitariums for Europeans in the tropical service. Mr. Chevalier has spent six weeks in such investigations in São Thomé, and a paper written by him on the results of his inquiries has been printed in French in *Occidente* (xxxiii, No. 1130, pp. 105-120, ills., Lisbon, May 20, 1910), from which the following facts are taken:

São Thomé lies in the Atlantic, the Equator passing through its southern edge, about 163 miles west of Gaboon (French Congo) and fifteen days by steam from Lisbon. Its area is 390 square miles and it is 31 miles long and 19 miles wide. The island of Principe, the other part of the province, lies ninety miles to the northeast of São Thomé, and its area is 49 square miles. Its population numbers only a few thousands and its agricultural production, chiefly cacao, is relatively small. The inhabitants of São Thomé are centered in the capital, of the same name, in seven villages and in about 250 roças or plantations scattered over the island. The population of the two little islands in December, 1909, was 68,221, of whom about 2,000 were Europeans, 23,651 natives of the islands, and the remainder, imported laborers and their families, nearly all from the west coast of Africa and 31,878 from the interior of Angola.

Both islands are exclusively igneous in their geological constitution. They form a part of the volcanic chain which extends across the Gulf of Guinea from the Spanish island of Annabon to the German peak of Cameroons on the mainland. The rocks are basalts, trachytes and phonolites. The volcanoes have long been extinct. A spring at the Santa Cruz plantation in São Thomé, discharging much carbonic acid, is the last known trace of volcanic activity. There are craters at or near the summits of the peaks and the remains of many others scattered over the island slopes. In the south of São Thomé are some gigantic monoliths of basalt, rising many hundreds of feet above their base, with vertical walls. The chaos of towering peaks, with precipitous faces, of deep narrow gorges half choked with enormous rock fragments, the wider, pleasant valleys, all the sharply contrasting and abruptly succeeding features of the landscape, testify to the power of the cataclysms that brought the island forth and to the ravages of time that have modified the forms of the surface.

Seen from the sea, São Thomé has the appearance of a fantastic chaos of mountains, cut up by ravines, some of the eminences surmounted by peaks that rise naked above the verdure and are lost to sight in the clouds that almost perpetually enshroud them. Ex-

cepting these higher points, the island appears to be completely covered with marvellous tropical vegetation, but this appearance is somewhat deceptive, for about half of the area of the island is now covered with industrial growths introduced by man. What gives from the sea the illusion of a vast forest covering the whole island is, in very large spaces, a spreading mass of fruit trees; and many of the forest trees were intelligently selected for preservation, when the land was cleared, to give shade to millions of cacao trees and banana plants. What seems, at first glance, to be virgin forest is, in fact, a great tropical garden of incomparable richness containing nearly everything that man draws from the vegetable kingdom for his needs; for even European vegetables thrive finely in this little land of many differences of altitude and climate.

Scarcely any country would seem, at first view, to be so little adapted for agricultural development. The stranger is lost in admiration as he observes by what enormous and patient toil the tangled forest on these slopes has been made to give way to large and well-managed plantations. The abruptness of the steep-sided valleys has been modified. Millions of tons of the rock fragments have been piled along the borders of the roads. Many of the torrents have been harnessed and are kept within bounds, and the giants of the forests have been cleared away. The cacao tree is thriving on the slopes of many valleys which were so steep that they seemed almost inaccessible to man. The visitor knows scarcely which to admire most, the fecundity of the soil which yields such splendid harvests or the patient and prodigious efforts of the Portuguese which have won so complete a triumph over savage nature.

Half of the island is now under cultivation; a quarter of it, in the central part, still forest clad, is adapted for reclamation and will be added to the industrial area. The last fourth, comprising the marsh and dunes of the littoral, especially in the north and northeast of the island, the sterile and almost inaccessible peaks of the interior and the escarpments of basalt will never be of value for agriculture. The abundance of flowing water has greatly favored agricultural development. Few countries are so rich in running water. The people say there are as many rivers as there are days in the year. The cascades are almost innumerable, and nature thus affords a great reserve of water power, which is only just beginning to be utilized. Thanks to one of these cascades, the great plantation of Bóa-Entrada has now in operation an electric lighting plant. In some places towards the sea, the land slopes gently to the ocean, and in the northeast part of the island, where the precipitation is not

sufficient for some profitable crops, the streams flowing slowly over these narrow plains are utilized for irrigation.

The climate is clearly insular, very humid, and the temperature scarcely varies throughout the year. Still, there are important differences in climate, considering the smallness of the island. In the north and northeast, the dry season is of long duration. In winter, it is exceptional in this region, for rain to fall incessantly for many days. The city of São Thomé is in this zone. The rainfall here is about one meter a year, which is not sufficient for cacao cultivation without irrigation.

On the west coast, the annual rainfall is a little less than on the north shores, though the rainy season is longer, extending from the end of August to June 15.

The region of the high altitudes, through the center of the island, has its special climate. At the highest altitude, about 2,025 meters, the climate is moderate and humid and the temperature seldom descends below 0° C. or rises above 15°. Many specimens of European flora are found. The flanks of the mountains, from 1,200 to 2,000 meters, are usually enveloped in thick fog. In this zone, the temperature is usually below 20° C. and this is the region in which the Cinchona (quinine tree) thrives best.

The cacao tree is not easily cultivated at a higher altitude than 700 meters above the sea. The great plantation of Monte Café is at this altitude. The meteorological data for a year shows total rainfall of 2.739 meters, distributed in millimeters as follows:

Jan., 104; Feb., 20; March, 377; April, 405; May, 481; June, 69; July, 80; Aug., 49; Sept., 223; Oct., 481; Nov., 312; Dec., 138.

The mean annual temperature at Mont Café is 22° C. This is a little too low for the most successful cultivation of the cacao tree, but the lowest temperatures are in May and June during the repose of the tree. Cyclones which are so destructive to tropical agriculture in many lands, are almost unknown among the islands of the Gulf of Guinea. Strong winds are injurious to the cacao tree and it is raised only where it can be well sheltered.

This plant was introduced into the island in 1822, but little attention was given to its cultivation, and in 1869 only about 50 tons a year were exported. It was only in the last quarter of the nineteenth century that the crop began to be important.

The island was discovered in 1470 by the Portuguese navigators João Pedro de Santarem and Pedro Escobar. It was Dec. 21, the day of Saint Thomas. The island had no inhabitants. Almost immediately, it was apportioned among members of the royal house of

Portugal. In 1493 a part of the island was assigned to Alvaro de Caminha, who began to colonize São Thomé with slaves brought from the neighboring mainland. In 1522, São Thomé ceased to be a royal preserve and the island was thrown open to colonists from Madeira, and Jews, expelled from Portugal, were settled there. The Jews, as a race, have won little renown as agriculturists, but it was these Portuguese Jews who did most to develop sugar cane planting in São Thomé and to start an era of prosperity that is comparable even with that of these latter years. In the middle of the sixteenth century there were 80 sugar mills in the island and a population of 50,000 souls. From this era date many of the old monuments and ruined churches that are scattered around the bay of Anna Chaves.

Then, early in the seventeenth century, came the invasion of the Dutch and the ravages of French and British privateers. The island was ruined, the Portuguese colonists fled to Brazil, and the slaves and convicts, left to themselves, fell into a state of frightful anarchy and barbarism. The dawn of better times did not come for more than a century, and it was not till 1795 that the coffee plant was brought to São Thomé. Coffee became the staple product and retained its primacy till it was superseded by cacao.

Other export crops have been introduced, but they have been completely cast in the shade by the marvelous growth of the cacao industry. Sugar cane is still grown on some of the large plantations, but the industry is steadily declining. Liberian and Arabian coffee makes a good showing in the exports, but has been left very far behind by cacao. The kola nut, vanilla, Guinea oil palm and many tropical plants and essences give good returns, but are almost neglected. Cacao is to São Thomé now what gold was to California in the early fifties of the last century. All the European vegetables thrive at altitudes from 1,000 to 1,400 meters and may be planted or sown every month in the year; and many European weeds have also crept in and are a pest in the gardens.

The cacao export figures for this little island are very remarkable. The official statistics show that the value of the exports in 1900 was $4,217,652. The annual product has been increasing rapidly since then and the value of the exports in 1909 was $9,158,396. The total value of the cacao exports in these ten years was $68,219,854. On the other hand, the cultivation of coffee is steadily decreasing, having dropped from $721,952 in 1900 to $313,366 in 1909. All other exports are of small importance.

For some reasons, the future of the cacao industry would seem to be very brilliant. There are now about 75,000 acres in cacao trees

and there are 12,500 acres of young plantations that are not yet in bearing. Furthermore, there are about 62,500 acres of land well adapted for the cacao tree that await only clearing and cultivation to add them to the productive area. One plantation of only 2,500 acres reports a clear profit of $80,000 a year.

But the planters have some serious misgivings. The tendency of the price of this raw material of cocoa and chocolate is downward. New plantations are being opened in all the warm countries. The question of labor also is a grave problem that is yet far from solution. All the world knows of the serious charge that the system of recruiting labor in the Portuguese province of Angola, for the plantations of São Thomé, practically reduces the blacks who are thus engaged to a state of slavery. It is expected that the law of July 17, 1909, will do away with the evils that have disgraced the recruiting system; and new currents of immigration from Mozambique and the Cape Verde islands will help towards a solution of the labor problem.

But there is still another very serious question before the planters. The mortality among the plantation blacks is frightful. About 80 per cent. of their children are dying in their first year. About 10 per cent. of the plantation hands, men and women, die annually. This is a terrible condition that requires a remedy.

The exports are now three times as great as the imports, a fact that does not speak well for the social well-being of the populace. All these facts are blemishes in the history of São Thomé's remarkable industrial development. They are facts that the Portuguese Government should try to remedy. According to Mr. Chevalier, Portugal has done almost nothing for the colony from which it is drawing a fine revenue in export and import taxes. It is, however, now building a railroad from the coast which has reached Trinidad in the interior. Further than this it has promoted no public works. It is the planters themselves who have built the roads, cleared away the forests and done everything to make possible the wonderful development since 1870. Private initiative has wrought the transformation; and the Portuguese planters have good reason to be proud of the material results they have achieved.

KATANGA'S COMMUNICATIONS AND MINERAL WEALTH

According to information received by *Le Mouvement Géographique* (Vol. 24, No. 24, Cols. 295-298, June 12, 1910), rail laying had been completed for 171 miles on the second section of the railroad which the "Compagnie des chemins de fer des Grands Lacs" is building to circumvent the cataracts and rapids that obstruct navigation on the upper Congo. The first section, from Stanleyville to Pontierville, seventy-five miles, has been in operation for about two years and steamers launched upon the smooth waters above, have been carrying railroad material to Kindu where further obstructions are met. The second section of the road, starting from Kindu, will pass around the last obstructions to navigation and will terminate at Kongolo, just above the Iron Gates. This section is 217 miles long and the road-bed has been prepared for the rails to within twenty-five miles of Kongolo which stands on the left bank of the Lualaba-Kamolondo branch of the Congo.

This enterprise has been hastened as rapidly as possible in order to provide, through the Belgian Congo, a steam route between the mouth of the river and the great mineral field in the southern part of the Katanga province of the colony. Above Kongolo, the river is navigable for light draught vessels for 400 miles farther south. It is expected that the second section of the railroad will soon be in operation; and when trains are running to Kongolo there will be uninterrupted steam transportation along the Congo, by water or land, for about 2,250 miles, from the mouth of the river to Kalengwe Falls, the extreme limit of navigation.

The development of Katanga is now the foremost purpose in the policy of the Belgian Congo; and it is expected that, before very long, a railroad will be extended across the province from the head of navigation to the southern border. Then the mining region will have steam communications on or along the Congo to the Atlantic.

For want of railroad or river communications, Katanga has been almost isolated from the outer world. It is in the heart of central Africa and, until about three years ago, it could best be reached by the Zambesi, at Chinde or Tete, necessitating a journey of hundreds of miles on foot, as the tsetse fly prevented other means of transport. Then, the Rhodesian or Cape to Cairo railroad was completed to

Broken Hill, 250 miles from Katanga's southern border and the mining field could be reached from England in six or seven weeks. A branch of this road has now been extended to the border and England is only four or five weeks away. Another railroad has been pushing inland from Benguela, on the Atlantic. Its ultimate destination is the Katanga mining region. The road-bed has been graded almost to the Bihe plateau and rail laying is considerably advanced, but practically all work on the line is at present suspended.

Mr. J. H. Ivey, mining engineer, has a conservative and able article on "The Mineral Wealth of Katanga" in the Seventy-Seventh *Annual Report* of the Royal Cornwall Polytechnic Society (New Series, Vol. I, Part 2, 1910, pp. 329-342, Penryn), from which the following facts are condensed.

The province of Katanga has been specially favored by nature. It is well watered by the Luapula, Lualaba, Lubudi, Lufupo, and Lufira and their affluents, the whole of which finally coalesce in the Congo. Their trend is from south to north and, with the exception of the Luapula, they take their rise in the mountainous divisions between the Belgian Congo anl the British and Portuguese territories. The work of making the Congo-Lualaba system available for a steam route to the Atlantic is outlined above.

The country is generally well wooded, extensive patches of open bush alternating with smaller areas of unwooded lands. The copper belt, trending in a north-westerly, then westerly, direction, in the southern part of the province, includes a large area of sterile and uninteresting country on and about the outcrops of copper ore.

The average rainfall is about fifty inches a year. This is true for that part of the province south of 10° 30′ S. Lat., but further north, the rainfall is probably much higher.

The country generally lies at an elevation of 2,000 to 3,000 feet. The copper belt is of higher altitude, ranging to 5,000 feet and generally exceeding 4,000 feet. The climate on this belt is ideal and highly suitable to Europeans. Malarial fever is almost unknown, the only dangerous period of the year appearing to be at the change from wet to dry season (May and June) which corresponds with change from hot to cold weather. The early mornings are then often intensely cold, and great care must be taken to avoid chills. Off the copper belt the climate seems less agreeable, being undoubtedly hotter, and malaria, spirillum and blackwater fevers are prevalent.

Prospecting work in Northwest Rhodesia and Katanga was first begun in 1900 under the auspices of the Tanganyika Concessions

Company. The great success of the various expeditions is now well known. The deposits already located include copper, tin, gold, platinum and palladium ores, with coal and the necessary fluxes for smelting, hematite, limonite and limestones.

The outcrops of the copper deposits occupy a belt extending for a distance of about 200 miles, with a width of thirty-five to sixty miles. From Kambove Camp, which may be regarded as a center, the belt extends southeast for about 100 miles. From twenty to thirty miles from Kambove, the course of the belt is northwest, then generally due west to the Quilu river (Dikulive Mine), thirty miles west of the Lualaba. Here it abruptly turns to the south, and has not been traced beyond a few miles. Outside the area of this belt, and chiefly in the southeastern part of the state, are isolated groups of mines, possibly connected with the Rhodesian group of copper mines at Bwana, Mkubwa, Kansanshi, etc. The country rocks of the belt are alternations of sandstones and shales, in varying stages of induration, with limestones and hematite and limonite rocks. The deposits of copper ore occur in folds of the sandstone and shale strata in anticlines, synclines, etc. The greater number are anticlinal and form conspicuous landmarks, as the outcrops are invariably free from bush, with stunted herbage, and also devoid of ant-heaps. Copper exists chiefly as malachite but chrysocolla, azurite and cuprite are commonly found.

Mr. Ivey describes a few of the numerous copper mines on this great belt and among them he speaks of the Fungurume mine which, he says, can be quarried to a depth of 200 feet and is estimated to yield over 4,000,000 tons of ore to this depth, 7 to 8 per cent. being copper. In Kambove No. 2, the cross cuts at the bottom of the five shafts show from 13.3 per cent. to 17 per cent. copper. "These high values and the great extent of the deposits . . . will, no doubt, enable Kambove to rank among the very largest copper producers of the world. . . To enumerate only Dikurwe, Musonoi, Kolweze, Fungurume, Kwatabala, Kakanda, the Kambove and Msesa groups, with Chituru and Likasi is sufficient to warrant all the good things that have been said of the copper prospects of Katanga. There is, without doubt, enough copper reasonably developed, easy to mine, and favorably situated with regard to power, flux and fuel, fully to reimburse the shareholders of the interested companies for all their past and any future contributions."

The tin deposits (cassiterite) were first discovered by the prospectors of the Tanganyika Concessions late in 1903. The Busanga tin area is the best known and its probable extent and value have

been determined. The deposits have been exploited by sinking ninety-six pits, at regular intervals, over the supposed full stanniferous area (1⅛ million square yards). Sufficient work has not yet been done to say whether Katanga is likely to become a large producer of tin from reefs. There is no doubt, however, that the alluvial ground of the Busanga, Kasonso and other areas will, when the conditions are more favorable, yield, at a profit, large quantities of cassiterite. These alluvial deposits extend almost continuously over an area about equal to that of the county of Cornwall, where tin is mined in England.

In the Ruwe region, soil and subsoil of varying depths are often found to carry gold. In the roughly stratified sandstones, the broken up portions are very auriferous, the gold being in flat, angular pieces, sometimes with irregularly shaped nuggets weighing up to nine ounces. Nuggets of two ounces or more are of frequent occurrence. There is also much free gold. The gold is very pure. It is recovered by washing the dirt in riffled sluice boxes. Native labor is utilized in the mining and transport of the dirt and for feeding the boxes, under the supervision of one or two white men. The first six months gave an output of 2,770 ounces at a working cost of $8,805. Further large auriferous areas were opened out and the yield has occasionally been close to 1,000 ounces for a month's run.

The so-called hanging wall (bedded sandstone) carries small quantities of fine gold.

The "reef" (ore body) of finely bedded sandstones carries with other minerals, gold, silver, platinum and palladium. The ore body has been exposed by shafts, accompanied by driving and crosscutting, to sixty feet in depth and 1,000 feet along the strike. With platinum at gold value, the writer judges the mine proposition to be worth at least $10 per ton over five feet of reef.

The labor supply has, thus far, been ample. The "boys" have been recruited from Northern Rhodesia and, with a wise native policy there should be ample labor available from Katanga itself. The cost of labor has been very cheap, running from $20 to $25 per "boy" for a four months' contract, this price including recruiting charges and keep.

NOTES ON THE DESCRIPTION OF LAND FORMS.—I.

The Kamerun Region. By K. Hassert. (Forschungs-Expedition ins Kamerun-Gebirge und ins Hinterland von Nordwest Kamerun. *Zeitschr. Gesellsch. Erdk,* Berlin, 1910, 1-35.) An observer's manner of presenting the facts that he has observed is so intimately bound up with a reader's appreciation of the facts as they are verbally presented, that the reader's attention may sometimes be profitably directed to the terms and phrases employed by the observer, as well as to the things that the terms and phrases represent. In the same way, the general method that underlies a description is of interest, as well as the things that are described. The article above cited is significant in both these respects. It opens with a concise explanatory characterization of the region visited, phrased for the most part in technical terms, from which the reader may at once conceive a mental picture of its leading features, and thus prepare himself for the readiest understanding of the later pages, which are presented in a partly explanatory, partly empirical narrative. The opening characterization is, in brief, as follows:

The region visited consists chiefly of granites and other crystalline rocks, which during a long existence as a land area were worn down to moderate or small relief, and then broadly but not completely covered with sheets of trachyte and basalt. The compound mass was afterwards fractured in all directions, and the blocks into which it was thus divided were irregularly displaced, long enough ago for the higher ones now to be elaborately dissected, while some of the lower ones have been aggraded. Young volcanic cones also occur, sometimes holding lakes in their craters. Waterfalls are abundant in the highlands.

The evidence on which this general statement is based is not presented in the article above cited, but is presumably to be found in the *Mitteilungen aus den Deutschen Schutzgebieten,* to which reference is made. It is, however, not with that evidence that we are here concerned, but with the presentation of the conclusions based upon it. The presentation is most lucid; it leaves no feeling of inaccuracy or uncertainty in the mind of the reader, who must be greatly aided in coming on the essence of the whole story at the beginning of the article, so that the items of form mentioned in the succeeding narrative may be immediately assigned to their proper place in the region as a whole. The reader may thus from the outset and without difficulty form a sufficiently defined mental picture of the upland blocks, limited by abrupt but dissected scarps and traversed by the ramifying gorges of young streams, and of the intermediate lower lands, on which the rivers flow little below the general surface; and then bearing this mental picture in mind he may hope to give the details presented in the succeeding pages

their proper rank. This hope is generally gratified, for the narrative makes frequent mention of dissected scarps, lava-capped cliffs, deep gorges and broad plains, which can for the most part without difficulty be given their appropriate location; but the reading of the article would have been still easier if its items had been somewhat more explicitly stated in terms of the introductory scheme; and more geographical illumination would have resulted had more frequent and more explicit correlation been attempted between the land forms and the conditions of human occupation. Unfortunately, some of the pages are largely empirical, and it is then difficult to conceive the relative positions of the elements that make up the landscape.

For example, one reads in effect: "The constantly ascending path led us to a grass-covered surface, dissected by gorges . . . Suddenly the wide plain of Bangem opened before us. A sharp cone rose out of it like an island . . . We descended rapidly . . . to Nyandong . . . and near a bold rocky peak, that dominated the district like a Matterhorn, we crossed the Mwe, a fine river which flowed into a rock-walled gorge . . . We next entered a deeply dissected forested mountain mass . . . where the road was bad and fatiguing" (pp. 11, 12). One may here easily infer that the grass-covered surface, reached by an ascending path, was one of the uplifted blocks; that the wide plain of Bangem was an aggraded depression; and that the Mwe flowed, as if in antecedent fashion, from a depressed block into and through an elevated block; but it would surely be easier for the reader, and safer also, if these matters had not been left to inference, but had been explicitly stated by the writer. The larger part of this excellent article makes so successful a departure from the empirical style of geographical description prevalent in the pages of geographical journals, that one must wish that its explanatory method had been extended so as to characterize all its paragraphs, instead of nearly all. For those paragraphs which are characterized by explanatory treatment many a reader must be warmly thankful.

The Glaciers of the Venetian Alps. By O. Marinelli. (I ghiacciai delle Alpi venete. Memorie geografiche, No. 11, 289 pp. Florence, 1910; many plates and figures.) This painstaking memoir contains many years' records of persevering study by one of the most active and progressive of Italian geographers. The work is a masterpiece of thoroughness outdoors and in; for the author has not only examined every little glacier in the mountains, but has brought together and discussed an elaborate bibliography. The greater part of the memoir (pp. 10-159) is devoted to a detailed description of individual glaciers. Then follow (pp. 160-246) sections on classification, erosive action, moraines, and other general matters; and finally a chapter (pp. 247-278) on the climatic limit of snow in this mountain group.

In point of method, this work offers an interesting contrast to the article previously cited. The author contents himself with purely empirical descriptions on

the earlier pages, while giving an account of the existing glaciers, item by item, but in the later pages he enters upon explanation and generalization. He there recognizes that the forms of the mountains have been largely affected by the erosive action of the great pleistocene glaciers; and he explicitly points out that certain neighboring cirques may have been thus enlarged from their earlier arm-chair form, and eventually converted into the semblance of a sofa by the partial or entire destruction of the intermediate spurs (186-188). This suggests that the acute and serrate ridges represent the reduced and sharpened remnants of larger and more rounded preglacial features. The author also concludes that the little glaciers of to-day, although they are accomplishing some small measure of erosive work, have but slightly changed the forms left by their predecessors. It therefore follows that the sites of the existing glaciers might be described in terms of the work done by the ancient glaciers; yet, as above stated, the descriptive pages of the first part of the memoir give hardly a hint as to this illuminating conception. The terms there employed are all empirical, such as culminating point, rocky or vertical walls, channels, rocky spur, cavity, cirque, "conca," and "vallone." Even such phrases as a "conca hardly meriting the name of a cirque," or "a kind of elongated rocky cirque," do not express the forms thus described in terms of their origin.

In view of the great progress that has been accomplished in recent years respecting the series of mountain forms developed during the modification of normal valley heads by the erosive action of growing glaciers, it seems ultra-conservative to make no use of this progress in a matter so closely pertinent to it as the description of the small glaciers of to-day that occupy cirques excavated to various degrees of development by former greater glaciers. The whole trend of modern physical geography is toward the use of explanatory description, as far as it appears reasonably assured, especially in scientific memoirs. Explanatory description is, moreover, the most effective kind of description, because the terms in which it is phrased are so much better defined, and therefore so much more easily conceived, than empirical terms. Hence, it is to be regretted that the well grounded considerations which lead to the interpretation of cirques as glacially excavated valley heads in various stages of development should be postponed to the later pages of a memoir, in the earlier pages of which these considerations might have been put to practical use as furnishing the best means of concisely and intelligibly describing the higher parts of strongly glaciated mountains, in which the small glaciers of to-day linger.

Explorations in Bolivia. By P. H. Fawcett (*Geogr. Journ.* xxxv, 1910, 513-529). This paper may be taken as an example of an entertaining and lively account of an arduous journey. The author describes travel in Bolivia as beset with dangers, difficulties and discomforts of many kinds, including Brazilian outlaws, revengeful savages, tangled and thorny undergrowth in pathless forests,

heavy nuts that fall 100 feet or more with bone-breaking force, wild beasts on the land and ravenous fishes in the rivers, innumerable insect pests, and dreadful diseases. Hence it is natural enough that one who survives a visit to the interior of that country should return home well supplied with personal incident with which to lighten his report; but it is regrettable that, as a result, the objective description of the country itself should be for the most part relegated to the background. Physiographic observation was presumably difficult, all the more so as much of the journey was made in boats on forest-lined rivers that traverse plains; yet, as the author's first avowed object was to give "a general idea of Bolivia as it is to-day," something more specific about hills and plains and rivers would have been helpful. It is, however, highly significant of the unsystematized condition of present geographical methods that, when occasional mention is made of the landscape, which constitutes the stage on which all the Bolivian players act their parts, its features are presented to the mature readers of one of the leading geographical journals of the world chiefly in terms of the elementary nouns of school-day geography lessons, qualified with somewhat more grown-up but still untechnical adjectives. One reads such phrases as "across the passes of the Cordilleras are mule tracks following the long hog-backed ridges which extend like the tentacles of an octopus into the eastern forests," "mountain torrents which cut a roaring and resistless passage through their valleys of slate, gneiss and sandstone," and "a coffee-colored river cutting a sinuous course in a red lacustrine deposit"; but there usually is a disappointing absence of effective landscape description.

One of the few more significant statements is: "In the forest the accidents of the land-surface are for practical purposes [such as boundaries?] unrecognizable . . . No watershed is easily recognizable in the forests of this region" (524). A few more words here would have been very helpful in indicating the nature of the forest-covered plain: whether it is all subject to river inundation, as a large part of it would appear to be; or whether the flood plain area is really restricted to belts of moderate width, which stand a little lower than the rest of the plain. The latter would sometimes appear to be the case, for mention is made of the "great grass plains which lie inside the belts of rich forest bordering the rivers" (p. 515); but as the relative altitude of the grassy plains and the forested plains is not explicitly stated, the reader is left to inference where he would be glad to have observation. To be sure, topographical exploration in the forest must be extremely difficult, and likely enough no decision could easily be reached regarding the alternatives above suggested; but in that case even an explicit statement of mere inference or even of uncertainty by the observer would have been helpful to a reader who wishes to follow the author's account of "Bolivia as it is to-day."

The hills of Ricardo Franco are described as of exceptional relief; they "rise abruptly from the forest plains to a height of over 3,000 feet, crowned by formable precipices . . . reported . . . as impassable, owing to the terrific gorges which

cut up its sandstone formation" (p. 525). When the explorer crossed these hills, he found "the very accidented plateau . . . covered by long coarse matted grass, beneath which . . . the surface is strewn with sharp boulders . . . Day after day we came suddenly upon deep gorges, necessitating long détours . . . A few days later we got down with difficulty to the forest" (p. 527). The reader may perhaps picture this plateau as being capped with horizontal sandstones on a base of some weaker structure, elaborately dissected by retrogressive insequent gorges and ravines. If this be the case, it would seem to have been an easy matter for the author to make explicit statement of the significant facts, and thus relieve the reader from the uncertainty in which he must otherwise remain. Surely, the addition of a few technical or explanatory terms, like horizontal sandstones and mature insequent ravines, or something of like nature, would not be out of order in an article which abounds with strange words like pium, tucandera, chunta, espundia, barracas, haputama, apazancas, gehene, and mungruyu, these being the native names for various insects, diseases and other things, for which no equivalent is found in our vernacular.

W. M. DAVIS.

GEOGRAPHICAL RECORD

NORTH AMERICA

LAND SURVEYS IN ALASKA. The U. S. Geological Survey during the present year is making public-land surveys in Alaska under plans approved by the Commissioner of the General Land Office. An appropriation for this work was made at the last session of Congress. The appropriation is being used for subdividing the agricultural lands of Alaska so that they may be taken up by homesteads. The work to be done this season will cover the arable lands around Fairbanks, where many homesteads have already been taken up. A standard parallel and prime meridian will be established and, if time is available, some township lines will be run. The section lines will be run next season. These surveys are being made under the direction of Alfred H. Brooks, in charge of the division of Alaskan mineral resources of the Geological Survey. R. H. Sargent has direct charge of the field operations. He is assisted by C. L. Nelson, W. N. Vance, and S. G. Lunde. Mr. Sargent's party, which sailed from Seattle for Skagway on July 5, includes five or six other assistants, and additional men will be employed at Fairbanks, where horses and supplies will be purchased. The work will be carried on by three parties, each including six to twelve men and six horses. After organizing the work at Fairbanks, Mr. Sargent will go by trail to Valdez. He will make preliminary examinations in the Copper River valley for the purpose of preparing comprehensive plans for land surveys in that region. Mr. Brooks left Washington late in July for Knik and Cook Inlet, to make investigations on which to base land surveys in that district. Later he was to visit the Fairbanks parties. The Superintendent of the Coast and Geo-

detic Survey has sent a party to Fairbanks to make determinations of latitude, longitude, and azimuth to which the proposed land surveys will be tied.

Mountain and Valley Winds in the Yosemite Valley. In *Science* for April 15, 1910, François E. Matthes, of the U. S. Geological Survey, gives an account of the mountain and valley breezes in the Yosemite Valley which directs attention to the importance of these daily wind changes in that region. During the daytime, on the sunlit slopes, the dust from the horses' hoofs rises slowly in a cloud which accompanies the traveller who is ascending the zigzag path. On the shaded slopes the air currents set down hill, so that travellers who are descending continually meet their own dust, coming down from the trail above. In order to make the journey without the unpleasant accompaniment of the dust-cloud, the ascent should be undertaken when the slope is in shadow, and the descent when the slope is sunlit. This Mr. Matthes soon learned to do, successfully.

The up-cast and down-cast breezes alternate with rhythmic regularity. In the summer of 1905 the smoke from forest fires near the lower end of the valley was carried up the valley by the morning breeze, and by 9 or 10 A.M. it was hardly possible to see across from rim to rim. In the late afternoon, the down-cast mountain breeze swept the valley clear of smoke. This phenomenon continued daily for four months with scarcely an interruption: an almost tropical regularity, it may be observed, possible only because of the dominance of diurnal and the absence of cyclonic control. The placidity of Mirror Lake, likewise, depends on the blowing of the mountain and valley breezes. The water is most mirror-like in the early morning, when the down-cast mountain breeze has died out, and before the updraft of daytime has set in. The Yosemite Valley further shows very clearly the resemblance between the air-currents and the natural water-courses. The nocturnal down-cast breeze not only follows the bottom of the valley trough, as a channel, but also receives tributary air currents from the side valleys. Mr. Matthes speaks of the "chilling down-drafts that poured upon him," during his evening trips, from the mouths of the lateral hanging valleys. R. DeC. W.

The Des Plaines Valley of Illinois. The second of the educational bulletins of the Illinois State Geological Survey (T. W. Goldthwait, *Bull.* 11, Illinois Geological Survey, 1909, 1-103+x pages, with 9 plates and 21 figures) is another excellent example of the official publications by State geological surveys of the middle west for use of the people and the public schools of the region.

In simple, untechnical language Professor Goldthwait discusses the geography and history of the Des Plaines river, the structure and the concealed surface of the bed rock, and the glacial and interglacial deposits. The physiographic history of the Des Plaines is sketched, floods are discussed, and specific field trips in the area are suggested. L. M.

Climate, Man and Irrigation in the Gila Valley. Dr. J. Walter Fewkes (Smiths. Misc. Coll., quarterly issue, Vol. 5, Part 4, 1910) has made a notable study of the "Prehistoric Ruins of the Gila Valley," reaching some conclusions which are worthy of attention on the part of climatologists as well as of anthropologists and ethnologists. The region where the Gila River and its two tributaries, the Salt and the Santa Cruz, emerge from the mountains, has a rainfall not regular enough for successful agriculture without irrigation. The ancient irrigating ditches, which can be traced for miles, show that the prehistoric

inhabitants applied a more extensive system of irrigation than any of their contemporaries in other sections of what is now the United States. The district required large irrigation undertakings; this meant coöperation and intelligent leadership; and hence there resulted "a sociological condition higher than any that existed among bands of hunters, fishermen, or even agriculturists depending on natural rainfalls." Coöperation in irrigation naturally encouraged the construction of other large public works, for defence, or storage, or ceremony. Thus the Casas Grandes originated. Dr. Fewkes believes that the abandonment of the Casas Grandes resulted from an invasion of nomads in prehistoric times, (and not, it may be noted in passing, from a change of climate). This whole study emphasizes once again the far-reaching consequences which hinge upon the all-powerful control of climate over human life, in so many of its activities, and customs, and in its development towards higher (or lower) standards.

R. DeC. W.

Division of the Montreal River. In a paper read by Dr. Robert Bell of Ottawa at the Twenty-second Annual meeting of the Geological Society, last December, he described a remarkable example of change in the destination of a large river in which the stream has been diverted in post-glacial times into a new channel that carries its waters all the way to its present mouth in a straight course of 90 miles, which lacks only 45° of being exactly opposite to that of the upper part of the stream, as well as its former continuation below the point at which the change took place; that is to say, at a certain point the course of the Montreal River (flowing into Lake Timiskaming) was turned round through an angle of not less than 135°, or from a north to a southeast direction, and made finally to discharge into the Atlantic Ocean instead of Hudson Bay. This singular occurrence was rendered possible from the fact that in one part of its course the river was barely able to pass across what has now become a low divide, and that a slow rising or tilting of the land to the southward gradually stopped the northward flow of the river, while at the same time the changing conditions induced a process of "stream-robbing" through a dam of loose drift material a short distance east of this increasing obstruction. The paper described numerous facts, which, taken together, seem to prove the manner in which this important and interesting phenomenon was accomplished.

The United States Bureau of Mines. The act establishing a Bureau of Mines in the Department of the Interior, approved May 16, 1910, became effective July 1. Carrying out the intent of the law, the Secretary of the Interior has transferred to the Bureau of Mines the investigation of mine accidents and fuels, together with the personnel and equipment of these investigations. The fuel investigations under the Geological Survey have already resulted in a better realization throughout the country as to the value of fuels. One result of this work is that nearly all of the fuel now purchased by the federal government is bought on specifications and subject to test by the Fuel division, or purchased after examination made of the coal supplied by the mines from which coal is delivered to the government. The publications of the Survey relating to mine and fuel investigations will in the future be distributed by the Bureau of Mines. The first of the Bureau of Mines bulletins, the Volatile Matter of Coal, by H. C. Porter and F. K. Ovitz, will be published in the next few months. These publications when issued can be obtained by addressing the Director of the Bureau of Mines, Washington, D.C.

SOUTH AMERICA

THE MONTAÑAS OF WESTERN BRAZIL. Mr. A. Lange, who has been travelling in the regions of the Upper Amazon, sent the following notes to the *Bulletin* from the River Javary:

"As Montañas are to be understood the forest regions on both sides of the Amazon River, especially south of the river. The regions which are framed in by the Javary River on the west, and the rivers Acre and Madeira on the south, are generally designated as the Montañas. They consist of forests of immense extent, through which numerous rivers flow, all of which empty into the Amazon. For more than six months of the year, these regions are partly under water, and at times are rendered uninhabitable. However, there are scattered all over, areas which are high enough to remain dry even at the highest river. These areas are few and valuable. It is here that people can build houses, thus forming communities whose size and commercial importance depend upon their accessibility and the local conditions. On the lower Amazon, these towns are not more than about 100 miles apart, but here in the remotest parts of the Amazonian affluents, they are few and very far apart (between 200 to 300 miles).

"Rubber is the product which absorbs all the energy of this country, and it is by far the most profitable. Without rubber the population would have no adequate resources. As long as the working of rubber pays the ordinary laborer as much as 40,000 Reis ($12) a day, he will not bother with cultivating the soil. For this reason, it can easily be understood that the valley or Montaña region will not otherwise be developed; not that the natural conditions are unfavorable, but simply because labor and energy are lacking. The seringueiro or rubber-worker must subsist upon imported canned goods, although the land upon which he treads could give him meat, vegetables and fruit in abundance, if only the labor and energy necessary to produce them were at hand.

"The owner of rubber land lives on some high point of the river front. He has a concession of a certain number of rubber land areas, often extending as much as thirty to forty miles along the river front, and from fifteen to twenty miles back in the woods. To work such an area a force of fifty to seventy-five seringueiros is necessary. Their work consists in cutting a path through the woods, locating the rubber-trees, tapping the precious milk, and smoking it and practically represents the extent of the present development of the Montañas.

"Although these forests contain incalculable quantities and varieties of trees, of superior quality for industrial purposes, yet their existence is hardly recognized and, at any rate, is not utilized. There are immense fortunes in valuable trees which are now simply rotting.

"The possibility that white planters will ever cultivate this enormously rich land is still very remote. Nature taxes the intruder in these forests so heavily that no one is willing to risk life or health for any product that will not give large remuneration in a short time. Malaria and swamp fever attack man, even though the utmost care be taken to protect him against the infectious bite of the mosquito. The so-called pium is a veritable plague, causing small hemorrhages wherever it bites. The mysterious and fatal disease Beri-Beri has greatly increased the mortality in these regions.

"Attempts, however, have been made by white settlers in the lower Amazon Valley to cultivate this extremely fertile land. At Santarem, about 400 miles from the mouth of the Amazon, a colony of Americans from Mississippi settled

shortly after the Civil War. The labor conditions then prevailing in Brazil, and especially the use of slaves, corresponded with the customs of their former home, and for years they successfully cultivated cacao and coffee. But after the abolition of slavery in Brazil, they found themselves deprived of their slave help and, gradually gave up their work and, to-day only the memory of this attempt of white men to cultivate the soil remains."

CLIMATE OF CHILE. The climate of Chile presents many peculiarities of interest. In the late Dr. C. Martin's *"Landeskunde von Chile"* (Hamburg, 1909) there is a clear account of the climatic features which have been of marked consequence in the economic development of the country. Distance from the ocean, and altitude, have almost more influence than latitude. Along the coast the marine control is so emphatic that the seasons become merged, and lose their normal characteristics. From Tacna to Copiapo is the arid portion, with five distinct climatic zones, parallel wth the coast, between the ocean and the Cordillera. The warm region is between Coquimbo and Curicó, with dry summers, necessitating irrigation, but with sufficient winter rainfall. The rainy district is in the provinces of Valdivia, Llanquihue and Chiloe, where heavy rainfalls, alternating with strong northwest squalls, are common. The Patagonian and Tierra del Fuegan portion is very rainy along the coast, but inland the rains are less marked as they move up the valleys. The upper valleys are dry, and the pampa to the east is almost rainless. Forest fires occur in the sub-Andine transition belt. Descriptions are given of the weather in different parts of Chile.

Such an account of Chilean climates as this one makes the section on climate in the recently published *"Handbook of Chile,"* of the International Bureau of the American Republics (1909) seem almost hopelessly inadequate. At the present time, when so much accurate information is available concerning the meteorological conditions of Chile, there is no reason why any publication, especially an official one, should give its readers so poor a discussion of climate as that contained in this Handbook. R. DEC. W.

AFRICA

SCULLING MATCH ON THE ZAMBESI. The results of the sculling match on the Zambesi river, for the championship of the world, on Aug. 18, were known in every land on the following day, illustrating again the rapidity with which things are moving in Africa. Only a half dozen or so of white men had ever seen these falls, fifteen years ago, though Livingstone discovered them in 1855. Now, trains carry to them throngs of tourists who find sumptuous entertainment, at tip-top prices, while they utilize the many conveniences provided for comfortable inspection of this wonderful cataract.

The race was rowed a little above the falls, for the Victoria Falls of the Zambesi have a peculiarity that is all their own. Fancy rowing a race a little above Niagara! The waters there surge and foam along at breakneck pace; but the Zambesi waters, similarly placed above the falls, are comparatively smooth and move with scarcely accelerated speed to the lip of the chasm. One of the great world rivers, the fourth largest of Africa's splendid waterways, a mile wide, moves placidly and quietly to the gorge, and there is dropped 400 feet. It is the most unique and one of the most colossal facts in stream hydrography.

On the waters where Livingstone floated safely down to the island over whose edge he peered into the chasm, this race was rowed. It was his burning en-

thusiasm, his sublime faith in Africa, that kindled the mighty movement which is bringing about the transformaton of a continent. But even Livingstone would scarcely have dreamed that, in a few decades, men would gather from other continents to witness a sporting event in the middle of Africa, between athletes of London and Australia at the great falls he discovered.

Is there Progressive Desiccation in the Sahara? Reports of progressive desiccation in different parts of the world, leading to a belief in climatic change, may often be explained as the result of a change in government, or of a change in the character of the local population. Thus, a government which lacks power and does not properly direct the activities of its people, or decreased enterprise and energy on the part of the people themselves in their efforts to keep back the advancing sands of the desert, may readily lead to what travellers take to be signs of a progressive change of climate, from wetter to drier, resulting in the abandonment of the region by its inhabitants. A situation of this sort was described by Mr. Hans Vischer, before the Royal Geographical Society, in an account which he gave of a journey from Tripoli across the Sahara to Lake Chad. Ruined towns, monuments of ancient art and industry, prehistoric stone implements, and a few struggling villages where there are water-holes, show "the various stages of man's struggle against nature, and the unavoidable end—the dead and waterless desert." When man retreats, and the desert is left alone, the sands claim everything, just as the tropical forest covers the ground when man ceases to cut down the trees and bushes. The history of the country between Tripoli and Fezzan shows that the desert does not drive man away, but claims any ground left by him. The advance of the desert is following on the depopulation of the country, and not on any change of climate. There is every hope that the advance of the desert may be stayed within the next few years. With a strong government in Tripoli the people will gain confidence in themselves; the Young Turk element is making itself felt; with French garrisons in Aïr and Bilma old trade routes will be reopened, "and the oases will once more be held by men against the desert." R. DeC. W.

ASIA

New Meteorological Observatory in the Philippines. A new meteorological and geodynamic station has been established by the Philippine Weather Bureau in the town of Baguio, Benguet. The building is on an isolated hill, rising 216 feet above the Baguio plateau, whose altitude is 4,740 feet (mean). Construction was begun in November, 1907, and completed in September, 1909. The building serves a twofold purpose, as a sanatorium for the Mission of the Jesuits in the Philippines, and as a branch station of the Manila Observatory.

The first publication of the new observatory bears the date 1909. There is a summary report on the climate of Baguio, which "confirms the idea that Baguio is eminently fit to become the health resort of the Philippines and possibly of the entire tropical regions of the Far East." A previous report, "The Climate of Baguio, Benguet," appeared in the Annual Report of the Director of the Philippine Weather Bureau for 1901-02. The present report summarizes all available data up to the present time.

The equipment of the new Observatory comprises two anemographs, two mercurial barometers, a barograph, Marvin electric heliograph, Campbell sunshine recorder, electrically registering rain gauge, the usual thermometers; Piche evaporimeter; Richard psychrograph. There is also a microseismograph (Omori type). R. DeC. W.

EUROPE

Population of the Netherlands. The census of Dec. 31, 1909, gives the Netherlands a total population of 5,853,037, which is an increase of 1.38 per cent. in the last ten years. There are 2,896,154 males and 2,956,883 females. The density of population is 177 to the square kilometer. The population of the largest cities is Amsterdam, 566,927; Rotterdam, 415,168; Haag, 272,887; Utrecht, 118,877; Gröningen, 74,596; Haarlem, 68,244; Arnheim, 64,167; Leiden, 58,263. Of the total population, 4,114,759 live in towns. This is 70.3 per cent. of the inhabitants, while the agricultural population forms only 29.7 per cent. of the total.

New Map of Sicily. The representative of the Military Geographical Institute in Florence announced at the recent meeting of the Eighth Italian Geographical Congress, at Palermo, that a new survey of the whole island of Sicily has been planned and triangulation is already under way. The work will be carried out on a scale of 1:25,000.

Cold Spells in Europe. In the eastern United States we are so accustomed to the movement of our cold waves in an easterly direction, and to their association with northwest winds, that many persons are surprised to find that in Europe the cold usually comes from the northeast, and progresses towards the southwest. This is the natural result of the presence of the cold continental area to the east and of the warm ocean area towards the west. A study of several cold spells during the winter of 1908-09, in Central Europe, by Dr. A. Fessler (*Meteorol. Zeitsch.,* Jan., 1910), brings out very clearly the general conditions which are associated with several typical European "cold waves," using the word in a general sense. The progress of the 32° F. isotherm between October 16 and 23 shows most strikingly the movement from northeast to southwest, the water areas on the north and the mountains on the south serving as checks to the advance of the low temperatures in those directions. The winds were distinctly northeast throughout the cold area. Obviously, this was a clear case of imported cold, although local radiation played a part, locally, in lowering the temperature, and in lengthening the period of cold. A further study, of the "cold waves" of November and December, 1908, and of January, 1909, shows that they were all associated with an area of high pressure over the continent, which moved slowly towards central Europe, with easterly and northeasterly winds blowing from Asia and from Russia towards central Europe. In one of these cases, there was no cooling by local radiation, as the sky was continuously cloudy, with fog and rain. In another case, the cold was chiefly produced by local radiation. And in still another case, of a very different sort, there was active air movement from the northwest, with an initial lowering of temperature resulting from importation, followed by considerable cooling due to radiation. There seem, therefore, to be these three types of cold weather: (a) cooling by importation from the northeast, plus local radiation; (b) cooling by local radiation; (c) cooling by importation from the northwest, plus local radiation. R. DeC. W.

POLAR

Captain Bernier's Arctic Work this Year. Capt. Bernier, the Canadian Polar navigator, is now supposed to be in Canadian Arctic waters, with the Government's permission to attempt the Northwest Passage and bring his vessel around to Victoria, B. C. He sailed from Quebec on the steamship *Arctic,* in

June last. A letter received from him at the Department of Marine, dated Chateau Bay, Labrador coast, July 12, included this memorandum giving the programme of his two years' cruise, as follows:

From Chateau Bay he proposed to sail for Albert Harbor, Pond's Inlet, on the north shore of Baffin Island; thence he meant to proceed to Beechy Island, at the western end of Lancaster Sound. The next place of call would be Dealy Island, in Melville Sound, and then Winter Harbor on Melville Island, at the entrance to McClure Strait. From there he expects to complete the Northwest Passage to Herchel Island, next year, where the Arctic sealing vessels have headquarters. The remainder of the trip around Bering Sea to Victoria will be comparatively easy sailing.

Sunburn and Frostbite in the Antarctic. In Lieut. Shackelton's account of his South Polar Expedition he says it was quite a common occurrence to feel one side of the face freezing while the other side was being sunburned. The Manchurian ponies would have frozen perspiration on their coats on the sheltered side, while the other side was kept dry and hot in the sun. On Dec. 4 the men were marching stripped to their shirts, and were much sunburned, although at noon that day the temperature showed "10° of frost." These observations recall the note made by Scoresby, many years ago, regarding the difference between the sunny and shady sides of his vessel in the Arctic. Scoresby pointed out that the pitch bubbled in the seams of the deck in the sun, while, in the shade, the side of his ship was covered with ice. R. DeC. W.

PHYSICAL GEOGRAPHY

Tidal Results on the Pacific Coast. An extended series of tidal observations was obtained by the Canadian Tidal Survey during the summer of 1909, under the personal supervision of Dr. W. Bell Dawson, the Superintendent of the Survey. There were in all a series of twenty recording tide gauges in simultaneous operation along the coast of British Columbia. These were placed at carefully selected points with a view to utilizing them as a basis for the determination of tidal differences at intermediate places; and also to define the extent of the region which can be referred to each of the principal tidal stations for which tide tables are published. The results of these investigations, when reduced to practical shape, will appear in the Tide Tables for 1910. The tidal data for New Westminster, Frazer River, and for Port Essington, Skeena River, appear in "Notice to Mariners, No. 32, 1910." They afford examples of the general question of the progress of the tide in ordinary shallow estuaries, and in deep inlets. They are in no sense, therefore, of merely local interest or local application, but illustrate the rate of progress of the tide relatively to the depth of the channel or inlet.

GENERAL

Prof. George D. Hubbard, who has had charge of the work in Physiography, at the Ohio State University, for the past five years, has resigned that position to go to Oberlin College, Oberlin, Ohio, where he will have charge of the department of Geology.

Proposed Reform of the Calendar. The Society has received the following from Mr. Fritz Reininghaus of Zürich:

"I recommend the following reform of the calendar:

"The division of the year into twelve entire and two-half months; all entire

months to consist of 28 days, and the half-months of 14 days. The first of the two half-months will be placed at the end of the first half year, and will be known as the Summer half-month; the second half-month will follow the last month of the year, and will be known as the Winter half-month.

"The 365th and the leap-year's day will be placed at the end of the year, and will be quite independent of the week or month, so that these days will neither have the name nor the date of a week-day.

"I had at first expressed the idea (which I thought quite new) of dividing the year into 13 months of 28 days each; but it has come to my knowledge that this proposal had already been advocated by Auguste Comte, the philosopher, who died in 1857. After consideration, I would advise the above-mentioned division as being more practical.

"The advantages of such a calendar would be as follows:

"Each day of the week would be in its fixed and unchangeable place in the future.

"Each month would begin on the same week-day, this also applying to each year, each half-year and each quarter of the year.

"This division would make the week and month measures of time, because the units 'year' and 'month' would, by this means, become, with an insignificant difference, complete multiples, always equal, of the time-unit 'week,' which is not the case at present."

Mr. Reininghaus has also sent a fuller explanation of his proposition in a pamphlet entitled "Kalender-Reform Vorschlag."

INDEX TO METEOROLOGISCHE ZEITSCHRIFT. Everyone who has to do with meteorology or with climatology will always find the *Meteorologische Zeitschrift* an absolutely indispensable source of information. It is the authoritative meteorological journal of the world. The use of this journal has been very greatly facilitated by the recent publication of an author and subject index, covering the period 1884-1908, *i. e.,* twenty-five volumes (Braunschweig, 1910, Friedrich Vieweg und Sohn). Those who use this index are pretty certain to miss no important publication issued during the period in question. The index includes all titles listed in the bibliography, although these may not have been noticed or reviewed in the text. R. DEC. W.

HALLEY'S COMET. All observers seem to agree that the earth did not pass through the tail of Halley's comet, as it had been predicted it would do, on or about May 18. Mr. Knox Shaw, in No. 4418 of the *Astronomische Nachrichten,* says that the tail was only 8° wide when observed on May 18, and its increased breadth next morning suggests that it was bent back in the orbit and probably did not begin to sweep past the earth before 12h., Greenwich mean time, on May 20. At this time the earth was some four million miles south of the comet's orbit plane, and consequently the tail probably passed well to the north of the earth, for the Helwân observations, during May, suggest that it was not nearly wide enough to envelop the earth at that distance. They also show that its length was well over 20,000,000 miles, and would therefore have enveloped the earth if the planes had coincided. No sign of the comet's transit of the sun's disc was observed, although observations were made with the 4-inch Cooke equatorial.

Sleeping Sickness. *Petermans Mitteilungen* (11 Halbband, 2 Heft, 1910) has a map showing the geographical distribution of sleeping sickness and illustrating an article on the subject by Dr. G. Meyer. The map is based upon those published by the British Sleeping Sickness Bureau (Oct., 1910), which is active both in investigation and publication. The thirteenth *Bulletin* of the Bureau (Royal Society, London, 1910), begins the second volume of this useful publication. The *Colonial Reports* (Miscell., No. 65, Dec., 1909, London), have a "Report on the Measures adopted for the Suppression of Sleeping Sickness" by Dr. Hesketh Bell, in which he gives an historical account of the progress of discovery and research, and a summary of the results gained, with regard to sleeping sickness. *Nature* (May 5, 1910) in a summary of this paper, says that the researches of Kleine and Bruce have shown that the trypanosome of sleeping sickness goes through a developmental cycle in the tsetse-fly, and that once the trypanosome has established itself, the fly remains infective, apparently for the rest of its life, without again feeding on the blood of an infected person. It follows that the period for which healthy persons must be removed from the fly belts, in order to insure that infection has died out in the flies, is much longer than was thought, and cannot at present be stated definitely. There are two other possibilities that complicate the problem of the transmission and spread of the disease. One is that an infected tsetse fly may transmit the infection to its offspring. The other, that some vertebrate animal other than man may harbor the trypanosome of sleeping sickness in its blood and so be a "reservoir host" which keeps up the infection in the flies. Further, to keep the natives, probably much against their inclination in many cases, more than two miles from the shore along the immense coastline of the Victoria Nyanza is a task of considerable difficulty. The natives are evicted from homes which they and their ancestors have inhabited for untold generations and moreover, most of them are sceptical as to the agency of the tsetse fly in the transmission of the disease. It is therefore probable that in spite of administrative prohibitions, some natives evade the regulations against frequenting the danger zone.

As to the distribution of the disease in Africa, at the present time, it extends on both sides of the Equator about half way to the tropics, from the Atlantic eastward to Victoria Nyanza and Lake Tanganyika, and it has already appeared on the northern shores of Lake Nyasa. It is claiming victims in the islands of Principe and Fernando Po, Gulf of Guinea. The most southerly point it has yet reached on the coast of the mainland is Benguella, Angola. While the stamping out of the terrible disease is not yet in view, there are some hopeful indications. It is said that a majority of the mild and some of the severe cases are now cured by the Atoxyl treatment. For a long time, it seemed as though everyone afflicted with the disease was doomed.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Across a Continent in a Man-of-War. Being the Log of Commission of H. M. S. "Pelorus," 1906-1909. With a full account of her cruise of 2,000 miles up the Amazon. By E. E. Highams. xvi and 239 pp., 38 plates from photographs, sketch map, table of distances and index. The Westminster Press, London, 1909. 5 s.

Only 36 pages in this small volume are devoted to the "full" account of a voyage "across a continent in a man-of-war." The attractive title must be called somewhat misleading. On the other hand, it is a pleasure to find here correct statements, all the more impressive because they are brief and artless, in regard to the climate and accessibility of the chief towns of the Brazilian State of Amazonas and eastern Peru. The *Pelorus,* a cruiser of the third class (length 300 feet, breadth 36½ feet, displacement 2,135 tons), was the first British warship that ever went up the Amazon to Iquitos, 2,037 miles from Pará. The only difficulty experienced in navigating the great river is referred to under date of Saturday, February 6, 1909: "Got under weigh [way] at six o'clock and proceeded [up stream from Jacaretuba, about 38 miles west of Manãos] at the usual speed against a strong current, the course having to be altered incessantly to avoid the logs with which the river abounds at this time of the year. These are very dangerous to the ship, and the propellers are also liable to get foul and broken by striking the débris which is torn from the banks by the current." Nothing whatever obstructed or impeded either the routine of physical drill on board, morning and evening, or the athletic sports—the rowing and cricket matches, the tennis, tug-of-war, football, and even golf—that kept officers and men in good humor and good health. The climate is characterized as "hot and very damp," yet it has no terrors for such a well disciplined ships' company.

The author says that the voyage, almost to the foothills of the Andes and back again, was a "very pleasant trip on the Amazon of 4,000 miles, and extending over six weeks, during which time we were very cordially received and fêted by all with whom we came in contact, and who, at the different ports, tried to outdo each other in their hospitality by showing their appreciation of our visit to their waters . . . Very little sickness was contracted during the journey, and there were no fever cases; the only drawbacks being the mosquitoes and [other] insects, which swarm aboard and rob one of a good deal of rest at night, and the very exorbitant price of food-stuff, due to the duty imposed, which is very high."

MARRION WILCOX.

Daniel Boone and the Wilderness Road. By H. Addington Bruce. 8vo. xiii and 349 pp. The Macmillan Company, New York, 1910. $1.50.

Books about this great pioneer-explorer are always welcome, for we are glad to be reminded, time and again, of the noble quality of the man and to hope that his tribe may increase. Like all unselfish men, he was pretty badly treated by his compatriots of the period, but this is a story so often told that it is hardly worth passing mention. The human coyotes got their chance under cover of law, and Boone being a large-minded, law-abiding character, they succeeded as soon as lawyers had to decide matters on technicalities. Thus it was that after years of devotion to the country which he opened up with fearless energy and where he justly claimed some land, he found himself "burdened with debt, without a yard of land to his name, and pauperized."

The author tells of occurrences through Boone's active life and correlates them with other events of the time. This gives the reader an opportunity better to judge of the remarkable exploits of the great hunter than if the references to other figures of the time had been curtailed.

Deprived of his property, Boone left his old battle-ground, being no match for commercialism, and settled in Spanish territory, now the State of Missouri, where 850 acres were given to him and he was made a magistrate. His countrymen still pursued him. The region was added to the Union, and once again, and this time in his old age, he was pauperized through technicalities. But the Kentuckians began to realize who Daniel Boone was, and the intercession of the Legislature of that State caused Congress to take action which somewhat mitigates the blush we feel to-day. Boone's claim was confirmed; but heroes do not always live to be 75. The author gives the story to the end, which came at Femme Osage in 1820, Boone then being 86, and having witnessed the success of his brethren of the wilderness, Lewis and Clark, and the opening of the new West by the fur hunters who followed.

The Government of North Dakota. By James E. Boyle, Ph.D. xcv and 320 pp. American Book Company. New York, 1910.

A book written for schools but as full of information as a cyclopedia. The text is not confined to North Dakota, but reviews the whole scheme of American government, Federal, State and local, particular attention being devoted to the last. A statement of the nature and principles of government opens the book, the rise of American institutions is then sketched, and a general analysis follows systematically. In the appendix are the Articles of Confederation, the Constitution of the United States, the Enabling Act, Constitution of North Dakota, etc. Prof. Boyle's parents were pioneers in Kansas and he is able to see things from a Western standpoint which generally means breadth of view.

Traité de Géographie Physique. By E. de Martonne. Parts 3 and 4. Armand Colin, Paris, 1909 5 frs. a Part

The first three parts of De Martonne's treatise, and the introductory chapter of part 4 (comprising Sections 1 and 2 as published) were reviewed in the July *Bulletin* (p. 533). In Section 3 the cycle of stream erosion is first discussed and the principle of physical evolution here set forth is kept in view throughout the remaining chapters on landforms. The discussion of entrenched meanders (pp. 431-436) is open to criticism, inasmuch as the author, attempting to prove that meanders of this type cannot result from the incision of normal river meanders following uplift of the region, bases his arguments on the erroneous

assumption that meanders incised after uplift would be cut vertically downward and so would not show the steep "under-cut" and gentle "slip-off" slopes which actually characterize entrenched meanders. A consideration of the laws of meander migration would show that spurs enclosed by entrenched meanders must have asymmetrical slopes, whether the meanders develop during the normal down-cutting of an irregular stream in its first cycle, or are inherited from a previous cycle in which the meanders were well developed.

In the chapter on the influence of rock character upon earth sculpture, we have an unusually full consideration of the effects produced by the mechanical and chemical composition of various rocks upon landforms. Much needed emphasis is placed upon details of sculpture of wide-spread occurrence, but little treated in most works on physical geography. Our admiration is qualified, however, for a classification of rocks (pp. 447-451) which makes all metamorphics altered sediments, which has no place for altered igneous rocks, and which gives the student the idea that gneiss is ordinarily the product of contact metamorphism induced in a layer of sediment by an igneous intrusion, leaves much to be desired.

On pages 474-475 we find the Grand Canyon of the Colorado and the platform in which it is cut described and figured as two strikingly different features produced in one cycle of erosion because of difference in rock resistance. As authorities for this interpretation the author quotes Davis, and Huntington and Goldthwait. Yet a large portion of Davis's paper is devoted to proving that the features in question cannot be regarded as the results of one cycle of erosion; and the paper by Huntington and Goldthwait names, describes and figures the two different cycles represented by these features. The description of a platform in the depths of the canyon (p. 475) also appears to be based on a mistaken reading of Davis's paper.

The influence of geological structure on relief is the subject of a chapter in which faults and folds are described and their topographic expression discussed. A chapter on volcanic forms is introduced by a few paragraphs setting forth the geographic interest of volcanoes, and concluded by an account of the geographic distribution of these forms. The author next discusses the evolution of landforms and the development of drainage patterns, topics already considered to some extent in previous chapters. Especial emphasis is laid on the development of drainage on coastal plains, and on the evolution of fault scarps and folded mountains. The Hurricane Ledge in the Colorado Plateau is cited (p. 558) as an example of a fault line cliff facing the up-thrown block, giving a reversal of the true fault topography; Huntington and Goldthwait are quoted as authorities. Here again the author seems to have misread the paper from which he quotes, for Huntington and Goldthwait, in common with other students of the region, have shown that the Hurricane Ledge faces the downthrown block, and in the region especially studied is a true fault cliff of comparatively recent date.

A discussion of "paleogeography" is of doubtful service in such a treatise as the one before us, and it does not appear that the chapter on this subject adds to the value of the book. "Glaciers and glacial topography" furnish material for an interesting chapter which shows that the author is pretty well convinced of the efficiency of glacial erosion. In discussing "aeolian action and desert forms" the attention is directed to need of appealing to normal stream erosion for many features found in desert regions. That the discussion

of "Shoreline Topography" is far from satisfactory will be apparent from an inspection of the author's classification of shorelines (pp. 697-706) which makes distinct classes of (a) embayed coastal plains, (b) embayed coastal plains with bay bars and lagoons, (c) embayed coastal plains with bay bars and marshes; but has no place for shorelines on uplifted coastal plains.

The remainder of the work, pp. 711-862 is devoted to the subject of "Biogeography." There may be differences of opinion as to the wisdom of including this subject in a treatise on physical geography, but the reader will find much to interest him in the abundant illustrations of geographic control here set forth. The physical features which most affect the distribution of plants and animals, and the general facts of such distribution are quite fully discussed.

Among the admirable features of De Martonne's work are the large amount of the new material drawn from a wide range of reading, the full list of references appended to each chapter, the excellent photographic illustrations, the effective drawings by the author, and the clear manner of presentation. Among the defects are the lack of emphasis, throughout much of the work, of the human aspects of the science, the inadequate treatment of shorelines and certain other types of landforms, and the evidence of careless reading of authorities quoted. In spite of these defects, the reader will find De Martonne's treatise a most valuable and interesting book. D. W. J.

Land und Leute Monographien zur Erdkunde. Herausgegeben von A. Scobel. Verlag von Velhagen & Klasing, Bielefeld und Leipzig, 1900-1910:

3. Norwegen. Von Prof. Dr. Sophus Ruge. Zweite Auflage bearbeitet von Prof. Dr. Yngvar Nielsen. 151 pp., map, 119 illustrations, and index. 1905.

5. Die Schweiz. Von J. C. Heer. 197 pp., map, 181 illustrations, and index. Third Edition, 1907.

6. Oberbayern. München und bayerisches Hochland. Von Prof. Dr. Max Haushofer. 120 pp., map, 102 illustrations, and index. 1900.

7. Deutsche Ostseeküste. Von Georg Wegener. 168 pp., map, 150 illustrations, and index. 1900.

8. Deutsche Nordseeküste. Friesische Inseln und Helgoland. Von Prof. Dr. H. Haas. 176 pp., map, 166 illustrations and index. 1900.

9. Der Harz. Von Fr. Günther. 151 pp., map, 129 illustrations, and index. Second Edition, 1910.

10. Am Rhein. Von H. Kerp. 201 pp., map, 192 illustrations, and index. Second Edition, 1908.

11. Die Riviera. Von W. Hörstel. 176 pp., map, 160 illustrations, and index. Second Enlarged Edition, 1907.

12. Rom und die Campagna. Von Otto Kaemmel. 194 pp., map, 156 illustrations, and index. Second Edition, 1906.

13. Der Schwarzwald. Von Prof. Dr. Ludwig Neumann. 167 pp., map, 171 illustrations and index, 1902.

14. Berlin und die Mark Brandenburg. Zweite neubearbeitete Auflage von Felix Lampe. 211 pp., map, 147 illustrations, and index, 1909.

16. Dresden und die Sächsische Schweiz. Von Prof. Dr. Sophus Ruge. 175 pp., map, 148 illustrations, and index, 1903.

These volumes (large 8vo) are specimens of the geographical monographs, very beautifully produced, which the well-known map house of Velhagen &

Klasing has been publishing, for some years, under the general title of "Land und Leute." They are intended for popular reading and are sold at small prices. In no other sense are they cheap, for they rank among the best descriptive works on the countries of which they treat and they are certainly not surpassed by any other series of geographical monographs as specimens of fine book-making and in their perfect reproduction of well-selected photographs. Geographically, they are sound, as they should be, for the writers of these monographs are geographers whose work is well known, and not a few of them are among leading geographers of Germany, professors in the higher schools of the country and widely known for their contributions to geographical literature. Mr. Scobel, the editor of the series, is among the leading cartographers of the day. Each volume has a list of works on the country, a comprehensive index and a good map.

Les Warega. (Congo Belge.) Par le Commandant Delhaise. Avec une Préface de Cyr. van Overbergh. xx and 376 pp., map, plan and illustrations. Large 8vo. Albert De Wit, Brussels, 1909.

This volume is No. 5 in the valuable "Collections de Monographies ethnographiques" which are being published in Brussels. The present work describes a peculiarly interesting people of the eastern Belgian Congo. The Warega, living in the Great Forest, extend from the Congo River eastward, almost to lakes Tanganyika and Kivu, mainly between 2° and 3° S. Lat. The forest has isolated them and they have fortunately escaped prolonged contact with the Arabs. They are a fine tribe, pure in blood, practicing polygamy only in moderation, once cannibals but eating human flesh no longer, unspoiled children of the forest whose degree of civilization may be measured by the respect in which they hold women, in which regard they have a place of honor among African peoples. They travel little and live contentedly on their clearings or on the small areas of grass land that are scattered through the wide forest. Their most conspicuous industrial attainment is in iron smelting and working, in which they are skilful.

Commandant Delhaise, who was stationed among the Warega two years (1906-7), has dispelled the mystery that involved this unmolested and comfortable people. His large book gives a systematic and complete description of the tribe and its country. A considerable number of photographs, at the end of the volume, are referred, by numerals, to various parts of the text. There are plans of a Warega village and of Micici, the chief government post; also a black and white map of the country. The soil is well adapted for the production of many crops and European vegetables of all kinds are raised at the colonial stations.

The Valley of Aosta. A Descriptive and Historical Sketch of an Alpine Valley noteworthy in Story and Monument. By Felice Ferrero. xvi and 336 pp., 3 maps and 39 illustrations. 8vo. G. P. Putnam's Sons, New York, 1910. $2.

This beautiful Italian valley is not yet very well known to American tourists. It runs up into the Alps from a point not far to the north of Turin, and it is claimed for it that it contains the best Roman ruins outside of Rome and Pompeii, besides scores of mediæval castles that are well worth visiting. The valley, with its ramifications, also leads up to the highest peaks of the Alps. All who

visit it go there with this purpose distinctly in view, for the valley is not on an international line of transit.

Mr. Ferrero divides his book into three parts according to time. The first part deals with the valley as it is now, the second, with the valley of the Roman era, and the third, with the valley as it was in the Middle Ages. The treatment throughout will be found most helpful to visitors. The book is neither superficial nor ponderous. It is both readable and informing. The most casual observer, if intelligent, desires such help as the book will give him to see, appreciate and enjoy the valley of to-day; no less does he need the bits of history and description that will augment his enjoyment and understanding of the splendid Roman ruins and the works of the Middle Ages. The illustrations are admirable.

Mr. Ferrero tells of the ascents of the high Alps from the southern side, achievements that are much less known than those of the northern approach. He says that the Gran Paradiso is the last stand of the ibex among European mountains. It once roamed throughout these mountains, and fifty years ago there were still enough left to permit free hunting. It is now forbidden to hunt the remnant remaining, estimated at about 600, and the Italian Government deputes their protection to some forty hunting guards.

Geography of the Middle Illinois Valley. By H. H. Barrows. xii and 125 pp., 16 plates, 47 figs., and index. *Bull.* No. 15, Illinois State Geological Survey, Urbana, Ill., 1910.

The appearance, a few years ago, of two now familiar books on the influence of the physical geography upon the history of North America was followed by a wave of appreciation from historians as well as geographers. It was asserted that at last we had begun to cultivate a great field of research, but the authors of these stimulating books, no less than the critics, were aware of their very general nature and of the tremendous task to which they were but the invitation. Certain exaggerations, however, crept into our geographic speech. A great truth had been discovered at last; history would have to be entirely rewritten; the touchstone in the study of all human development everywhere is geographic influence. It required the piercing through again and again—chiefly by historians—of these bald generalisations to make us see that they were but the ghosts, so to speak, of an idea often asserted in the past and as often denied, because too little detailed and too much general work on the problem had been done. When a student actually put his hands to a concrete task involving the relationship of geography and history the ghost was promptly laid, at least for him.

All this does not mean that the idea of geographic influence in human development is abandoned; for it never stood on a firmer basis. We have merely arrived at the stage where there is no bone to our contention. The historian grants geographic influence: he only wants us to consider other factors, sometimes of more, sometimes of less, but always of some importance. When we deal with the facts of a people's development we deal with time as well as with space, and time involves many facts of human origin, ultimately of geographic origin, it may be, but so long and so far removed from earth forces that their preservation, present use, and relationships, are in the nature of history, because they are matters not of observation but of long and, oftentimes, of involved record. One can not prepare a complete account of human develop-

ment on the basis of field observations alone; the arduous, prolonged examination and analysis of books of record are also required. We who ourselves clamored for a well-balanced history in which the geographic factor should find a place were the first to forget the importance of some of the biggest non-geographic factors.

The second stage of development of the historico-geographic field has now been entered. Students are working up the facts and laws of the evolution of the people of a small tract, with due attention to all the recognisable factors, before setting their hands to a continent.

The "Geography of the Middle Illinois Valley" is, in the reviewer's judgment, the most important work of its kind yet published in America. The first half of the book deals with the physical geography of the area, the second half with its settlement and development. The work shows as intimate a knowledge of history as of geography—a rare condition. It nowhere vaguely generalizes, nor generalizes at all without first showing precisely where and what the historic basis is. Yet neither the record nor the analysis is ever lost in mere detail. The style is clear, and the whole treatment sequential, scholarly, genuine. The educational bulletins of the Illinois State Survey are all of high grade, but we believe that there is not among them another so solid and praiseworthy as this.

It is shown that the Illinois Valley has formed in the past the greatest natural highway between the Great Lakes and the Mississippi. Explorer, fur-trader, settler, all alike were guided by it. Even to-day the counties bordering the Illinois River and the Illinois-Michigan canal contain 51% of the people of the State. The southern part was settled from the South and Southwest, the northern part from the Middle Atlantic States and New England. The southern wave seemed likely at one time to become the dominating one, owing, among other things, to the navigable streams, the highways of the pioneer, that here border Illinois, and to others that lead naturally from east to west. With the opening of the Erie Canal in 1825, the later development of steam navigation on the Great Lakes, and the decline of shipping and agriculture in New England, immigration into northern Illinois actively began, but not until the movement from "the land-hungry, agricultural South" had gained great headway. The fear that the State would be dominated by southern institutions and ideals caused Congress as early as 1818 to place the northern boundary, not on the parallel of the southern end of Lake Michigan, as originally intended, but north of it, so as to give it a 50-mile water frontage, and thereby invite northern settlers and political influences through closer commercial relations in that direction. Steam navigation on the Great Lakes was the greatest influence in bringing settlers to the doors of the State. From 1840 to 1850 Chicago grew 700% and from 1836 to 1846 its imports increased over 500%. Goods could be shipped north as well as south from the central Illinois valley. A choice of markets—St. Louis or Chicago—was now afforded, and agricultural expansion became extremely active. Of great interest is the history of steamboat navigation on the Illinois River itself. In 1833 there were three boats on the river; in 1850 there were 1286; in 1852 there were 1800 arrivals of steamboats at Peoria. With the cheap and extensive building of railroads over the flat prairies steamboat navigation on the rivers declined. Many towns fell into decay. Only those continued to grow rapidly whose positions were favorable from the standpoint of the railroad, or whose natural advantages were of a special order.

The New England farmer conquered the prairies before the southerner did.

A rough stratification of settlers followed. Tongues of southern influence extended north along the timbered lowlands and valley slopes and the timberless terraces on the valley margins, while the northern settlers pushed south over the intervening interstream prairies. Prairie development was, however, only actively begun when the railroad permitted freer cross-country transportation, for the earliest settlers had, perforce, to locate at least within striking distance of the river in order to get their goods to market.

The last important phase of development is related to canal construction across the State, which brings the discussion down to the Lake-to-Gulf Deep Waterway. Lack of space forbids even the mention of many other features of equal importance. It is a matter for heartiest congratulation that so excellent a piece of work has been done, and we earnestly hope for other papers of a like sort from the same source. I. B.

The Log of the "Laura" in Polar Seas. A hunting Cruise from Tromsö, Norway, to Spitzbergen, the Polar Ice off East Greenland and the Island of Jan Mayen in the Summer of 1906. Kept by Bettie Fleischmann Holmes. 137 pp., many illustrations from photographs, map, game list and meteorological table. Small 4to. The University Press, Cambridge, 1907. (Not in the trade).

A very handsome book recording, with vivacity and enthusiasm, the adventures of a hunting party from Cincinnati, including two ladies. Few keen sportsmen know much of the pursuit of game in such out of the way hunting grounds and the author is to be commended for the pains she has taken to explain and describe all that is of novel interest. The photographs are especially fine and chiefly illustrate hunting and ice fields.

Quer durch Abessinien. Meine Zweite Reise zu den Falaschas. Von Dr. Jacques Faïtlovitch. xv and 188 pp., 60 illustrations from original photographs and map. M. Poppelauer, Berlin, 1910. M. 5.

Researches in Abyssinia, in the past twenty years, have clearly shown the important Jewish element in Abyssinian history and also that many Jews are among the present population. Their fathers, for many generations, have handed down to their children of to-day the faith of Israel. They are called by the preponderant Abyssinian population "Falaschas" which means "foreigners" and thus they are distinguished from the autochthonous inhabitants. They have preserved their racial characteristics and, to an important extent, their purity of blood though there has been considerable admixture with the indigenous peoples. Jewish blood is said to flow in the veins of the Empress Thaitu, widow of the late emperor Menilek II; and her husband took great pains to preserve the tradition that he was descended from King Solomon and the Queen of Sheba.

Dr. Faïtlovitch has been conspicuous as a student of the Jews in Abyssinia whose presence there was first revealed by the Scottish explorer James Bruce. Some of the more important results of Dr. Faïtlovitch's journey among them in 1904-5 have been reported in the *Bulletin* (Vol. xxxix, 1907, p. 62). The present book includes his discoveries at that time and also the results of his second journey in 1908-9. The volume embraces a large amount of detailed information and will undoubtedly be accepted, for a long time to come, as the authoritative compilation of facts relating to this interesting people.

Les Premiers Jours de la Turquie Libre. Lettres d'un Témoin. Par Camille Fidel. Publication du Comité de l'Asie Française. 77 pp. 8vo. Soc. générale d'Imprimerie et d'Édition levé, Paris, 1909.

The author travelled through Turkey and other Balkan countries, soon after the recent revolution in Turkey. He records his impressions of those countries and gives the views of leading men with regard to the new régime at Constantinople.

The Elements of Pilotage and Navigation. With Notes on the correction of Compasses. By Lieut. Maxwell H. Anderson, Royal Navy. 82 pp., diagram and maps. 8vo. J. Griffin & Co., Portsmouth (England), 1908.

Combines the elements of pilotage and navigation in small compass.

Land Teaching. A Handbook of Soils, Plants, Gardens and Grounds for Teachers and Cultivators. By H. E. Stockbridge, Ph.D. vii and 131 pp. and illustrations. Southern Ruralist Company, Atlanta, 1910. $1.

Written in the effort to bring country school children close to the land. A source of much information that may help teachers to teach successfully.

Aus dem unbewohnten Innern Islands. Ódádahraun und Askja. Von Heinrich Erkes. Mit einer Skizze des Gebirgsstockes Dyngjufjöli und der Askja. 64 pp., map and bibliography. 8vo. Fr. Wilh. Ruhfus, Dortmund, 1909. M. 1.50.

The description of the lava wastes of Ódádahraun and Askja, in the northeastern interior of Iceland, is reprinted from the *Mitteilungen* of the Dresden Geographical Society (Heft 9, 1909), with the correction of some errors and a few additions to the text. In Part 2, the author has translated into German various writings on the exploration of Askja.

Fernando Cortes and the Conquest of Mexico, 1485–1547. By Francis Augustus MacNutt, Translator and Editor of the "Letters of Cortes." xii and 475 pp., 6 maps, 14 illustrations, and index. G. P. Putnam's Sons, New York and London, 1909. $1.35.

An addition—a real addition—to the valuable "Heroes of the Nations" series, this volume contains an account of the events in Mexico during the first part of the sixteenth century, together with estimates of the so-called Mexican "civilization" and a review of the career of Cortes from his birth, at Medellin in Estramadura, to his death, at Castelleja de la Cuesta, near Sevilla. The author's reasonable view of the writings of his predecessors in this field may be suggested by a citation from pages 53 and 54:

"Between the dazzling word-pictures of Prescott and Helps, on the one hand, and, on the other, Alaman's depressing sketch of a squalid town of hovels, inhabited by bloodthirsty cannibals, there is still room for a beautiful city, in which dwelt a sovereign amidst surroundings of interesting splendor.

"An entire school of present day investigators rejects the descriptions of Mexico given by the early writers as entirely fanciful, and asserts that the city presented few points of superiority to an ordinary Indian pueblo of New Mexico or Arizona. Repudiation of what has come down to us from numerous observers, who contradict one another about almost everything else, but were in

general accord concerning the aspect of the capital, its arts and degree of civilization, assumes the existence of something resembling a conspiracy of misrepresentation among the early Spanish writers.

"Even without conscious intention to mislead, it was inevitable that the Spaniards should fall into exaggeration in describing the city of Mexico: first, because they necessarily used the same terms to portray what they saw as they would have used in describing Rome, Paris, or Constantinople; second, because the contrast between such Indian towns as they had seen and the capital was undoubtedly very great, and their long years of rough life, perilous voyages, and the absence at times even of shelter from the elements, made any large town where some system of order reigned and where there were houses having court-yards, gardens, and embroidered hangings, seem worthy to be compared with great cities elsewhere seen and dimly remembered; and lastly because Mexico was unquestionably a very beautiful city."

That is an acceptable opinion, and it is expressed in terms of respectful consideration of the sensibilities of "present-day investigators," and with equal regard for the reputations of the three principal sixteenth-century authorities. Behind Prescott and Helps stand, of course, Las Casas, who wrote of what he himself had witnessed; Gomara, who "only began his 'Cronica de la Conquista' some twenty-five years or more after the events . . . and under the inspiration and direction of Cortes, then Marques del Valle, whose chaplain he had shortly before become"; and Bernal Diaz del Castillo, who fought shoulder-to-shoulder, valiantly, beside Cortes, and wrote his "true" history in order to correct Gomara's misstatements. The author of this most recent work in the same field has succeeded in steering a middle course between such extremists as Gomara, the old apologist for Cortes, and Señor Alaman, whose unquestionable talent has been enlisted for the much-needed work of destructive criticism.

The extraordinary interest of the old version has been retained in the present work. On the other hand, the influence of what might be called the "new learning" is shown in the cautious acceptance or discreet rejection of some striking features, episodes, and details of the story of the conquest or the descriptions of Montezuma's "empire." The weak, easily misled Mexican ruler, upon whose superstitious fears Cortes played so successfully, had been, it will be remembered, chief of the priesthood, before he became chief of the state and supreme director of the national defense. Therefore the glimpses which are afforded of the national religion, with its abominable rites (including human sacrifices and cannibalism) have a value that cannot be overlooked, although that part of the subject may seem most repulsive. The native warriors would not avail themselves of such opportunities as were presented from time to time during prolonged hostilities to kill their enemy, who seemed to them a godlike person—if not actually one of the gods. Their ambition was to take him alive, in order to sacrifice him on the altar of their "old established" monstrous deity, Huitzilopochtli, the god of war, whose image (compare Bernal Diaz) is thus described:

"Its face was distorted and had terrible eyes, the body was covered with gold and jewels, and was wound about with the coils of golden serpents; in the right hand was held a bow, and in the left a bundle of arrows. Suspended from the idol's neck was a necklace of human heads and hearts made of gold and silver and studded with precious stones . . ."

And what was (to this most civilized, yet most barbarous, Amerind nation)

the true and inner meaning of such terrible rites? We rescue from a foot-note (pp. 18, 19), the following suggestion:

"This practice [sacrificing and devouring human beings] is traced by some historians to the tribe of the Mexi, which descended from Tenoch . . . Prisoners taken in war were the most highly prized victims, but, failing these, or for the celebration of minor festivals, slaves were easily bought, or were offered by their owners for this purpose. Small infants were also commonly sold by their mothers, and instances of free-born men offering themselves as victims were not unknown. The victims were frequently drugged, in such wise that they went unconsciously, or even willingly, to the altar. If a great festival, requiring many and choice victims, fell in a time of peace, war would be undertaken upon any frivolous pretext in order to procure the desired offerings. The warrior who had captured the victim in battle would not eat of the latter's flesh, as a sort of spiritual relationship was held to exist between them, not dissimilar to that of a sponsor and his god-child in Christian baptism—or even closer, for the flesh of the victim was considered also as the very flesh of the captor. The eating of this human body was not an act of gluttonous cannibalism alone, but was believed to have mystic significance, the flesh having undergone some mysterious transmutation, by virtue of the sacrificial rite, and to be really consecrated; it was spoken of also as the 'true body' of the deity to whom it was offered, and also as the 'food of soul.' None but chiefs and distinguished persons, specially designated, was permitted to partake of the sacramental feast, which was celebrated with much ceremony and gravity. If the victim was a slave, the rites were similar, but simpler." M. W.

Motoring in the Balkans. Along the Highways of Dalmatia, Montenegro, the Herzegovina and Bosnia. By Frances Kingsley Hutchinson. 341 pp., map, over 100 illustrations from photographs by the author, and index. 8vo. A. C. McClurg & Co., Chicago, 1909. $2.75.

The automobile being an innovation along most of the 1,483 miles traversed by Mrs. Hutchinson and her party, it made a decided sensation among the live stock on the way. The author, with characteristic Chicago enterprise, secured a photograph of a horse that had just dragged his vehicle over a stone wall in his frantic desire to give the strange machine the whole road. In the capital of Montenegro, the author was told that its ruler, Prince Nicola I, father of the Queen of Italy, was attending service in a certain church. "Will he let me take his photograph when he comes out?" she asked. The soldier merely shrugged his shoulders. But the Prince and his two daughters were duly snap-shotted as they were walking home, and the picture is the frontispiece of the book.

Mrs. Hutchinson is a vivacious writer, with a keen eye for the novel and the picturesque. The lands and peoples of the western Balkans are among the few new things left for the globe-trotter and the author writes about them, not only in an entertaining manner but also with the evident purpose of showing how much pleasure and profit may be derived from a visit to this little known part of Europe.

Aztecs and Mayas. By Thomas J. Diven. Two Vols. Vol. I. pp. 248. 12mo. The Antiquarian Company, Chicago, 1909. $1.

While this volume is written in a somewhat hetereogeneous and fantastic manner the author is serious and his conclusions in the main accord with those

accepted today by the majority of the ethnologists and archæologists of this country, and are stated in their works. In some passages he is extremely personal and derogatory. Any book must be lowered by this practice. He is also inclined to be dogmatic as, for example, when he says "no book on any subject should ever be printed larger than a duodecimo." Besides this is not pertinent to archæology.

Less than a third of the book is given to the Aztecs and Mayas, but as this is only the first volume the deficit may be made up in what is to follow. In delimiting the "Arizona field" as he terms the Pueblo region, he omits everything north of the Colorado and San Juan. It is true the many-storied house has not been found there, but the remains (house-walls, pottery, etc.), indicate the same level of culture and the same stocks, reaching at least as far north in Utah as the Pine Valley Mountains and the Pink Cliffs. The reviewer has found coil-made pottery on the Sevier far below Panguitch, and it is not improbable that ruins may be discovered in that neighborhood also. The "Arizona field" then should be limited on the north by at least the parallel of 39°, especially as the canyons of the Colorado, of the Green and of the Grand around and above their junction, as far as Gunnison Crossing, are all full of ruins. Indeed at present it is difficult to say where the northern limit may be. Pottery has been found at Salt Lake.

He refers to numerous perforated stones discovered in this field and endeavors to fathom some of their uses. Stones of a similar kind are found all over the United States. In Reykjavik, Iceland, is preserved an ancient loom, such as was used by the early Scandinavians, and it is a good example of a primitive loom, showing each thread of the warp drawn taut by a heavy stone tied to the bottom end through a perforation. As this was one of the earliest types of loom, the world round, and as the natives of this continent were primitive weavers on similar looms it seems probable that many of the perforated stones were used for this purpose. The more primitive the weaver the more irregular these weights would be.

The author declares himself not satisfied with this present work and says he was overwhelmed with other cares during its preparation. It is a pity he did not wait. As he says that his task has just begun with this book it may be wished that the succeeding part may be more consecutive in thought and free from aspersions.

In Closed Territory. By Edgar Beecher Bronson. xix and 299 pp., nearly 100 illustrations from photographs by the author, outline map of British E. Africa and index. A. C. McClurg & Co., Chicago, 1910. $1.75 net.

Mr. Bronson's hunting tour was through the same wild game regions visited, soon after, by Mr. Roosevelt. He spent thirteen months shooting there and tells the story of his many adventures with the art of the practiced writer. Though the book will especially interest those who love the wilds and the pursuit of its big game, it contains much that will profit the general reader. He says that the white settlers, stock raisers and farmers have already taken up about 12,000,000 acres on the high plateau of British East Africa. On account of the enormous quantity of big game, they find it difficult to maintain fences. There is a general feeling that the Government should cease to extend its protection of game over immense regions that are capable of development and changes in the game laws are now under consideration. Mr. Bronson adds: "Give the settler a free hand and a year or two will see easy shooting ended within seventy-five miles of the railroad."

The Conquest of the Missouri. Being the Story of the Life and Exploits of Captain Grant Marsh. By Joseph Mills Hanson. xvi-458 pp., map, 36 illustrations and index. 8vo. Chicago, A. C. McClurg & Co. 1909.

In the physical development of the United States certain men have been particularly identified with certain regions and the relation of their doings and observations, consequently, forms a basic part of our history. While the exploits of politicians and of soldiers are seldom overlooked, and often are credited with more value than they deserve, the isolated individuals dealing mainly with natural obstacles, with no oratory or bugle-blast to sound their victories, frequently vanish with little or no record of their doings. Sometimes they fall upon a biographer, and we are grateful to Timothy Flint, for example, for giving us the story of the Patties, to Dr. Peck for that of Daniel Boone; and to authors like the late Dr. Coues for reprints and analyses of obscure relations.

In the volume here noticed we welcome a recent addition to the list. It presents the career of a pioneer navigator of the Missouri who was a part of its history: Captain Grant Marsh. Mr. Hanson has performed a valuable service and he has performed it extremely well, making a book that is entertaining, graceful and accurate. In order to insure this latter quality, he submitted many of the chapters for critical reading to persons recognized as authorities on the subjects involved. Instead of giving Captain Marsh's story by itself, he has interwoven with it a great amount of contemporaneous history to round out the tale and properly adjust it to other events. In this way he comes to relate the sad story of the disaster on the Little Bighorn. This is very clearly told. Captain Marsh was in command of the supply steamer, *Far West*, which was in touch with the troops during the whole of the period, and brought out the first authentic news of the annihilation of Custer's command.

Before closing, a remark on the method of writing the name of the river on which the battle occurred may be in order. The author gives this "*Little Big Horn*" and the main river, "*Big Horn*." Though this is not uncommon, it should be discontinued. The river was named after the Bighorn mountain sheep, and the reference is to the animal, not to the horn. Consequently, it should be written "Bighorn."

The Picturesque St. Lawrence. By Clifton Johnson. xi and 253 pp., and 47 full-page photographs. $1.25. The Macmillan Company, New York, 1910.

Travelers along the St. Lawrence from Kingston to the Gulf will find this volume a valuable hand-book for the journey. After the opening chapter, which tells of the discovery of the river and the adventures of the early navigators, the description begins with a chapter on Kingston and the Thousand Islands. Historical and legendary stories of the various stopping places are introduced throughout the book. At Kingston the author begins his journey and proceeds down the rapids to Montreal, halting now and again to inspect a settlement or to interview a villager. Montreal and Quebec are treated in long chapters which summarize their eventful history and describe their charm for the tourist. The large tributaries of the river receive attention in several chapters; the romance of the Ottawa with the story of Daulac's glorious and fateful foray against the Iroquois; the Richelieu and the gateway to the south by the way of Lake Champlain; the St. Francis, highway to the Connecticut river, which "has known the wail of human distress at every turn in its winding

course," and in whose valley is found to-day the city of Sherbrooke, a picturesque and distinctly Canadian settlement near the Vermont border line; and finally the beautiful Saguenay, from its ancient fur trading center of Tadousac, now a resort for such as delight in noble scenery and good fishing, to Chicoutimi, the lumber yard of the north. The author hardly does justice to the lower stretch of the St. Lawrence; his scenic wonders culminate with the Saguenay. Many an excursionist will find, with the reviewer, that the Saguenay loses, by comparison, something of its wonderfulness if it be approached from the Gulf where the massive, towering Percé Rock on Gaspé peninsula stands near the end of the southern bank of the river; and along the south shore with its many interesting fishermen's villages nestling at the foot of wild hills and mountains.

The book ends with an appreciative chapter on the St. Lawrence in winter. Many photographs which, in themselves, give much information add to the value of the little work. For those who are familiar with the great stream this book will stir up pleasant memories; for such as are interested in history and romance, there is found here a summary of these phases of the river; and for the prospective voyager, the volume will serve as an impetus and a guide to his travels along the pathway of one of the world's noble rivers. R. M. B.

Auf Neuen Wegen Durch Sumatra. Forschungsreisen in Ost- und Zentral-Sumatra (1907). Von Max Moszkowski. xvii and 328 pp., maps, 243 illustrations and index. Dietrich Reimer (Ernst Vohsen), Berlin, 1909. M. 14.

The scene of the author's studies, which were mainly of an ethnological nature, is the sultanate of Siak on the river of that name, and its hinterland on the tributaries of that river. It is located on the east side of Sumatra, between 0° 30′ and 2° N., and 101° 30′ and 103° E. The native tribes whom he met on those rivers represent, as in a museum, the various stages of primitive man in a geographical distribution which makes the author plead very strongly in favor of a climatology, as well as psychology or physiology, of races. The great contrast between the climates of the eastern and western parts of Sumatra is most instructively reflected in its inhabitants. The highland of the west, blessed with an eternal spring, resplendent with light and color, are the home of a, comparatively, highly civilized race, with a gay and artistic temperament; the lowlands of the east, on the other hand, with the damp hothouse atmosphere of their tropical forests, have been unable to produce even the lowest stages of a civilized existence. The soil furnishes its inhabitants their scanty sustenance without any special effort on their part. Any stimulus to make them wish for more is absent, and if they felt it, what would be the use of ploughing and sowing as long as the passing of an elephant herd would suffice to deprive them, in one night, of the results of their labor? Besides, the care for the morrow is eliminated where nobody knows whether there will be a morrow for him or whether the tiger, or a falling tree, or the treacherous climate of the forest, will have disposed of him before the day closes. Thus the tribes of the forest, the Akits, go on living dumb and indifferent, the darkness in their minds being the counterpart to that of their forests whose green shades are never penetrated by the rays of the sun.

They have remained nearer the original condition of primitive man than almost any other savages of whom we know. They have no agriculture, no industry, no art, no inventions of their own. They live in a kind of house boat,

huts built on rafts. In the wilderness, the river is the only open space on which one can build a house or hut without the implements of a higher civilization. Their rafts are either fastened to the shore, or float on the river in true nomadic fashion. In a few places they are also found on land, but then they are raised high on piles—on account of the dampness and danger from sudden floods on the ground—like regular lake dwellings. These tribes live without any state organization and without any form of government.

If these savages may be said to represent the lowest stage in the development of the human race, those on the upper course of the river, the Sakeis, may properly be called the connecting link between them and civilized man. They are not mere "collectors" of food, like the Akits; they have mastered the elements of production. They have a distinct social organization of a matriarchal character. They have not yet established, however, any division of time; they have no calendar, no fixed hours even for sleep and waking, no religious beliefs, no poetry or music. A few superstitious rites are clearly foreign importations, of Malayan origin.

On the Tapung, one of the upper branches of the Siak, the influence of the mountains begins to make itself felt. The valley widens, the inhabitants are an active and industrious race. They are blacksmiths, carpenters, joiners; their tools are adorned with pretty patterns in which Indian influences can be traced; their houses are well built, they cultivate rice and other tropical foodstuffs. Their government is carried on by means of a regular feudal system on a matriarchal basis.

In the mountains, at last, the Rokan states on the river of that name are actual patriarchal despotisms. Their inhabitants live in really comfortable houses, they are skilful farmers, perfect artists in wood-carving, and they have even a script of their own—a fact not even known of the Malays.

In the concluding chapters of the book the author develops, on the basis of his observations, his theories on the origin and development of human habitations, art, religion, music and poetry, thus making the book, indeed, what he promised: a contribution to the history of mankind. Tracing in the forests of Sumatra the development of social institutions, from aggregations of people who merely keep company, to perfect state organizations, he discovers striking analogies with the different stages of development of the white race. The point of importance is, however, that these analogies hold only for part of the process. At a certain point, the possibilities for further development of the colored races seem exhausted, and only the white race continues. Hence he strongly opposes the hypothesis brought forth by so many well-meaning philanthropists, that the colored races differ from the white only in not having reached the goal yet, but that they will reach it sooner or later. If they have not reached the goal by this time, he argues, it means that they will never reach it because they are not able to reach it. He points to the fact that both races started for the goal at the same time, in the same original conditions, and with the same chances for reaching it; but for causes not yet ascertained—maybe climate, or environment, or adaptation and heredity, or natural selections, or whatever influence—the development of the colored races was cut short, and thus the degree of civilization at which we find them now would represent the upper limit of their possibilities. The logical consequence of this argument is, naturally, a warning not to treat the colored races as equals, not even as some-day-equals, of the white, but rather to assign them their place, however humanely, as the inferior and

servant members in the great organism of mankind, and to abstain, of course, from intermarriage altogether in order not to lower the standard of our own civilization in the long run.

The book must be classed with the most noteworthy publications on the subject, and no ethnologist working along these lines ought to leave it unread.

M. K. G.

E. v. Seydlitz's Handbuch der Geographie. Jubiläums-Ausgabe Twenty-fifth Edition of Der grosse Seydlitz," edited by Prof. Dr. E. Oehlmann. xv and 848 pp., 400 figures, maps, and text illustrations. 4 colored maps, 30 colored plates and index. Ferdinand Hirt, Breslau, 1908.

The "Larger Seydlitz" has long ceased to be a mere school book. In the home and office, in the library of the scholar and the teacher, it is equally found as the faithful adviser and reference book which will answer almost any questions of a geographical nature that do not touch the domain of the specialist. This Twenty-fifth "Jubilee" Edition has been, again, not only revised and enlarged, but partly re-written to bring it up to the standard of the latest geographical discoveries and scientific progress. The chapters on Asia, Africa, and the Alps, are practically new contributions, and so is the chapter on Commercial Geography, into which Professor Friedrich of the University of Leipzig has introduced his treatment of the subject by economic zones which are related to, though not identical with, the heat belts, as first described in his well-known textbook of Commercial Geography.

In a book like this, which is intended for more or less practical purposes, the regional treatment of the countries stands, of course, foremost (540 pages out of 805). After that comes Commercial Geography (120 p.) followed by general (150 p.) and mathematical (20 p.) geography. In the treatment of the countries the natural divisions always precede the political ones; clever schemes to facilitate the inevitable memorizing of names and locations are used in many places, although in some instances (see: tributaries of the Mississippi, p. 34) the appeal to visual memory might as easily have a confounding, as a helping, effect. Also the endeavor to say as much as possible in as few words as possible often proves fatal to the smoothness and clearness of the style. Being written for German readers the book is, of course, most thorough in dealing with the countries of Central Europe, but it suffices to read, for instance, the chapters on North America in order to see that in spite of being brief the treatment includes everything essential in the other parts of the world. It is a queer lapse, however, that in a book of German origin, of all the suburbs of New York just Hoboken should have been omitted.

M. K. G.

A History of Sarawak under its Two White Rajahs, 1839–1908. By S. Baring-Gould, M.A., and C. A. Bampfylde, F.R.G.S. xxiii and 464 pp., illustrations and index. Henry Sotheran & Co., London, 1909.

The early histories of nations are the records of the deeds of their great men. As this was true in Greece long ago, so it is true to-day in the awakening of those parts of the earth where the making of nations has as yet hardly begun. Such a history is recorded in this book which tells how the two Brookes, uncle and nephew, gave the now independent state of Sarawak, on the northwest coast of Borneo, "a government for natives second to none;" but it also tells, as has so often been told in English colonial history, a story of the ingratitude of the

mother country toward those who devoted their lives to increase her possessions and her prestige in the far East.

Aside from the wonderful record of colonial achievement, which reads more like an heroic epic than like a chapter of very recent history, the book is full of new data on the ethnology of that great region. The native population, of Indonesian stock, is extremely heterogeneous, but the tribes resemble each other more or less in manners and customs, and the difficulties of classification are further increased by the fact that, in Borneo, a difference in names is not at all an indication of different origin. It seems that all these small tribes are remnants of a once powerful race that were driven from their homes to the jungle, where, under the influence of a more or less nomadic life, they relapsed into savagery. All these tribes are dwindling away, mainly in consequence of in-and-in breeding. The name of Dayaks is applied to two races fundamentally different. The Land-Dayaks are the weakest of the land tribes, abused and trodden on by every tribe on the island until the first white Rajah established law and order. The Sea-Dayaks, on the other hand, are Proto-Malays, that is to say, they belong to the same ethnic family with the Malays but probably descend from an earlier and less mixed type than the Malays of the present. They are dreaded pirates, especially on account of the sacred custom of head hunting. Of all the tasks which the Brookes set for themselves in pacifying the country, the taming of the Sea-Dayaks and the abolition of head hunting was one of the hardest because this barbarous practice had its roots, not in personal animosity against the victim, but in the hallowed belief that to every Sea-Dayak who dies an attendant must be given on his way to the Shades. In the present, the eighty per cent. of this tribe that are subdued have become as reliable and loyal servants of the new order of things as they were of the old.

Another difficult task was the preservation of the Land-Dayaks from entire extinction through the oppression of their stronger neighbors. This was impossible without strenuous measures against piracy and, in the end, a long and fierce war which ended in the defeat of the pirates (and in which the sympathies of the English Parliament were on the side of the defeated). Now, the Land-Dayaks have become prosperous farmers under a government which not only protects them against the loss of their harvests but makes them owners of their lands as long as they continue to cultivate it. Trade, on the other hand, is mostly carried on by the Chinese.

The natives have, through their chiefs, a share in the administration of the government and in its deliberations, and the selection of these chiefs has always been accomplished in accordance with the wishes of the natives. Sympathy between the rulers, who remember that the country originally belonged to the natives, and the people, who know that their present independence and prosperity are due solely to the efforts of their white Rajahs, has been the aim of the whole policy of the latter, and the results have proven the wisdom of this policy. Thus only is it possible that in that state thirty Englishmen can rule safely over 300,000 natives, assisted by a few hundred native policemen, and almost without written laws. No doubt this book "will stand in the future as a record of the work of private individuals who stood alone and unprotected in a foreign land," and, it is to be hoped, will be read with profit by all those who, in any country, go out to develop its foreign possessions and, incidentally, also by those who stay at home and have to decide upon the national policy which may further, or prostrate, their efforts. M. K. G.

Geologische Charakterbilder. Herausgegeben von Dr. H. Stille. Heft. 1. Eisberge und Inlandeis in der Antarktis. Von E. Philippi. Six Plates with descriptive Text. Gebrüder Borntraeger, Berlin, 1910. M. 3.60.

A new publication that promises to be of much value. It is proposed to produce superior pictures from photographs, illustrating the morphology of the earth's surface, the structure of mountains, the development of typical geological formations, etc., with descriptive and explanatory text. The plates in No. 1 (each 8½ x 6 or 6¼ inches, exclusive of margin) embrace the following views of Antarctic ice:

Das Inlandeis westlich vom Gaussberge; Tafelförmiger Eisberg, schwimmend. Posadowsky-Bucht; Senkrechte Wand eines etwa 40 m. hohen Eisberges mit deutlicher Schichtung und Schmelzwasserkanälen, eingefroren im Meereis der Posadowsky-Bucht.; Auf Grund geratener und in der Mitte geborstener tafelförmiger Eisberg, Posadowsky-Bucht.; Gewältzer Eisberg mit gerundeter Aussenseite und tief eingeschmölzenem Schuttbande in der Nähe des Gaussberges.; Schuttführende Wand eines Eisberges mit zahlreichen herausgeschmolzenen Geschieben. Posadowsky-Bucht.

The pictures show, with much clearness, a large amount of detail and each is fully described by Dr. Philippi, professor of geology in the University of Jena and the geologist of the German South Polar expedition on the Gauss, 1901-93. The publishers have in view five subjects for the succeeding numbers of 1910, and in the list of other contributors who have promised illustrated topics is N. H. Darton, the Washington geologist.

An Oriental Land of the Free. Life and Mission Work among the Laos of Siam, Burma, China, and Indo-China. 200 pp., map, illustrations and index. The Westminster Press, Philadelphia, 1910.

A book of ethnological and geographical interest. The author, a missionary of the Presbyterian Board of Foreign Missions at Chieng Mai, Laos, gives a very careful account of this numerous and wide-spread people, who live under the jurisdiction of the four different countries mentioned in the title. The missionary work among them is confined mainly to the large area east of Burma between the Salwin and the Mekong rivers; in other words, to the western half of Laos. Mr. Freeman gives a good description of the land, much detail with regard to the nature and life of the people and about a third of the book to missionary touring and teaching, the native church and the needs and opportunities of the work. While primarily prepared as a text-book for those who are studying Missions systematically, the book is valuable for general readers and libraries. The author says that the Laos people, in their migration from the east, were profoundly affected by only one outside influence, that of Buddhism, which gave them their alphabet, stimulated the growth of a considerable literature, and was great and beneficent in its educational influence.

A Labrador Spring. By Charles W. Townsend, M.D. 262 pp., 57 illustrations from photographs and index. 8vo. Dana Estes & Co., Boston, 1910.

An excellent book, and all the more useful because it relates to the Labrador coast, along the Gulf of St. Lawrence, which is in the Canadian domain and, even yet, is not thoroughly explored. It is only a few years since the Canadians had a clear idea of the tremendous volume of water-power, available for electrical purposes, that is supplied by the numerous rivers which drop

from the Labrador plateau, not far from the Gulf edge, down to the low coastal plain. It is said to surpass the available water-power at Niagara and will some day be utilized.

Dr. Townsend is not only a physician but also an ornithologist and he has a firm grasp on other subjects of natural history. His avocational attainments have enabled him to write a delightful book on the most conspicuous phases of the fauna and flora of this Labrador coast; and human studies also, both Indian and white, came in for a full share of his observations. The production of pulp-wood is now the leading industry, and it is gratifying to hear that the land is not entirely despoiled of its timber, but that forestry methods are employed and the continued growth of the forest seems to be assured. One of the most edifying chapters is that given to the Indians known as the Montagnais or Mountaineers, who live to the south of the Hamilton river while the Nascaupees dwell to the north of it. The Montagnais are nomads who trap for furs, far and wide, during the winter, and come down to the coast, in summer, to sell their products and reburnish their veneer of Christianity, for they are fond of religious feast days and of the ceremonials of the Roman Catholic Church.

It is surprising that so good a book, largely geographical, should be without a map. There is sufficient material for one and a good sketch map of this region, appeared in "La Houille Blanche" by E. Rouillard (*Bull.* Soc. Geog., Quebec, Jan., 1909).

Die Haupttypen des Sprachbaus. Von Dr. Franz Nikolaus Finck, v. and 156 pp. B. G. Teubner, Leipzig, 1910. M. 1.25.

The author, who is a professor in the University of Berlin, takes many characteristic texts from eight chief language types and, by comparison and discussion, gives an insight into the laws governing the formation of human speech. The languages with which he illustrates his subject are the Chinese, Greenlandic (Eskimo), Ssubja (on the upper Zambezi in South Africa), Turkish, Samoan, Arabic, Greek, and Georgian.

Die Sprachstämme des Erdkreises. Von Dr. Franz Nikolaus Finck. viii and 143 pp., and index. B. G. Teubner, Leipzig, 1910. M. 1.25.

Dr. Finck bases, upon the modern results of the study of languages, the comprehensive view which he sets forth in this book of the language groups of the earth, their ramification into single tongues, and the reciprocal coherence of these tongues.

Mensch und Erde. Von A. Kirchhoff. Dritte Auflage. 100 pp. B. G. Teubner, Leipzig, 1910. M. 1.25.

A reprint of this classical little work by the late Prof. Dr. Kirchhoff in which he treats, with consummate skill, of the inter-relations between man and his physical environment. Many notes have been added to the present edition, at the end of the book, giving further facts or comments relating to the text.

Die Grundzüge der Praktische Hydrographie. Von Richard Brauer. Bibliothek der gesamten Technik, 53 Band. 233 pp., 24 tables, 38 illustrations in the text and index. Dr. Max Jänecke, Verlagsbuchhandlung, Hanover, 1907. M. 3.40.

A concise and valuable work on hydrographic phenomena and on the methods, instruments and mathematical formulæ employed in hydrographical research and engineering.

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NEW MAPS

NORTH AMERICA

U. S. GEOLOGICAL SURVEY MAPS

CALIFORNIA. Map of California showing Drainage Areas and Locations of Sampling Stations. 1:2,500,000=39.4 miles to an inch. 15¼ x 18 inches. Pl. 1, *Water Supp. Pap.* 237: "The Quality of the Surface Waters of California," by Walton Van Winkle and Fred. M. Eaton. 1910. [Shows, in red, divisions of drainage areas and position of sampling stations.]

SOUTH DAKOTA AND WYOMING. (a) Map showing Distribution of Underground Water in the Dakota and underlying Sandstones in the northern half of the Black Hills region in South Dakota and Wyoming. 1 inch=4 miles. 44°-45° N.; 103°-105° W. 25¼ x 17¼ inches. Contour interval, 100 ft. By N. H. Darton. [Colored symbols to show outcrop areas of sandstones, approximate areas in which artesian flows may be expected, depths of Dakota and Minnelusa sandstones and location, with depths, of artesian wells and unsuccessful deep borings]; (b) Geologic Map of the northern half of the Black Hills region in South Dakota and Wyoming. Scale, coordinates, size and interval as on map a. By N. H. Darton. [Nineteen colored symbols for geological formations. Both maps illustrate Prof. Paper 65: "Geology and Water Resources of the northern Portion of the Black Hills and adjoining Regions in South Dakota" by N. H. Darton, 1908.]

WYOMING. (a) Map of Powder R. Coal Field, adjacent to the Burlington R.R. 1 inch=4 miles. 12¼ x 13½ inches. Inset showing coal sections; (b) Map of Buffalo Coal Field, showing sections of coal beds. 1 inch=4 miles. 10⅜ x 11 inches; (c) Map of T. 43 N., R. 79 W. 1 inch=4 miles. 8½ x 6½ inches. Contour interval, 100 ft. [Indications of coal outcrops and coal 500 and 1,000 feet deep]; (d) Map of Coal Field in S. E. part of the Bighorn Basin. 1 inch=4 miles. 9⅜ x 9⅝ inches. [Shows distribution of coal, shale, bone and sandstone]; (e) Map of eastern part of Litte Snake R. Coal Field. 1 inch=4 miles. 10⅞ x 10⅞ inches; (f) Map of southern part of Rock Spring Coal Field, 1 inch=4 miles. 16⅛ x 12⅛ inches; (g) Map of Rockfield Coal Zone in S. part of Rock Springs coal field, Sweetwater Co. 1 inch=1 mile. 12¼ x 29 inches. [All black and white maps in *Bull.* 381-B "Investigations of the Coal Fields in Wyoming by the U. S. Geol. Surv. in 1908" by R. W. Stone, and others.]

U. S. COAST AND GEODETIC SURVEY MAPS

UNITED STATES. Level Net of 1907. 1 inch=140 miles. [Illustrates "Pre-

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U. S. Hydrographic Office Charts

Pilot Chart of the North Atlantic Ocean, Sept., Oct., Nov., 1910.

Pilot Chart of the North Pacific Ocean, September, 1910.

U. S. Weather Bureau Charts

Meteorological Charts of the North Atlantic Ocean, September, 1910. [With description and charts, on the reverse, of the West Indies Hurricane, Sept. 16-21, 1909.]

Meteorological Chart of the South Atlantic Ocean, Sept., Oct., Nov., 1910.

Meteorological Chart of the North Pacific Ocean, September, 1910.

Meteorological Chart of the South Pacific Ocean, Sept., Oct., Nov., 1910.

U. S. Department of Agriculture Maps

United States. Soil Survey Maps of Hale Co., Ala; Caribou Area, Maine; Scranton Area, Miss.; Bates Co., Mo. 1 inch=1 mile. [In colors, with contours of elevation and descriptive text.]

West Virginia. Three maps of Wood, Ritchie and Pleasants Counties: (a) Topography; (b) General and Economic Geology; (c) Agricultural Soils. 1:62,500=0.9 miles to an inch. 39° 5′-39° 25′ N.; 80° 50′-81° 45′ W. 25¼ x 48½ inches. West Virginia Geological Survey, Morgantown, 1909. [Colored maps, based on U. S. Geological Survey sheets. On c, the results of the soils survey, carried out by the State Geological Survey in co-operation with the Bureau of Soils, U. S. Dep't. of Agriculture, are imposed upon the U. S. topographic sheets.]

West Virginia. Map of West Virginia showing coal, oil, gas and limestone areas. 1 inch=7 miles. 18 x 43 inches. Revised Edition. West Virginia Geol. Surv., Morgantown, 1910. 50c. [The first edition, published in 1908, was noticed in the *Bulletin*, Vol. 42, p. 396.]

SOUTH AMERICA

Argentina. Mapa de la Vertiente Oriental de la Cordillera entre 39° y 41° Lat. Sud. 1 inch=18 miles. 22¾ x 17 inches. Illustrates paper "Estudios Geográficos de la Vertiente Oriental de la Cordillera Argentina" by Dr. Franz Kühn. *Bol.* del Inst. Geog. Argentino, Vol. 123, Nos. 1-12, Buenos Aires, 1909. [The region mapped lies wholly in the Territory of Neuquen. Symbols are used for predominant land forms, and phases of vegetation.]

Argentina. Übersichtskarte der argentinischen Cordillere zwischen 39° und 41° südlicher Breite. 1:1,000,000=15.78 miles to an inch. 13½ x 16½ inches. Inset: Die interozeanische Wasserscheide in der Vega de Maipu. Scale about 6 times that of main map. *Zeits.* der Gesells. für Erdk. zu Berlin, No. 6, Berlin, 1910. [Illustrates paper: "Geographische Studien über Nord-west-Patagonien," by Dr. Franz Kühn. Topography and flora shown by brown and black symbols.]

Argentina (a) Copie du Cours du Pilcomayo prise sur la Photographie d'une ancienne Carte (auteur inconnu). Document inédit par E. A. Thouar. 7 x 9½ inches; (b) Cours du Pilcomayo. Par E. A. Thouar, 1909. 12½ x 9½

inches. [After Thouar's surveys and the work of other explorers]; (c) Cours du Pilcomayo. Par E. A. Thouar, 1900. Document inédit No. 3. 13 x 9 inches; (d) La Region de los Esteros entre el Pilcomayo superior é inferior segùn los Datos del Ingeniero Gunardo Lange completados por las Expediciones de Adalberto y Arnaldo Schmied en 1906 y 1907. 21 x 12¼ inches. [Symbols for routes, mountains, etc.]; (e) Región de los Esteros del Rio Pilcomayo y Rio Confuso con sus Alrededores explorada por Adalberto y Arnaldo Schmied en 1906 y 1907. 1:600,000=9.4 miles to an inch. 22½ by 12 inches. (f) Plano topografico del Rio Pilcomayo levantado por la Comision mixta Argentino-Paraguaya, 1906-1908. 1:482,700=7.6 miles to an inch. [This is the most detailed and accurate map of the lower Pilcomayo to the region, between 59° 20′-59° 40′ W. Long., where the river is lost in the Estero Patiño (swamps). The place where the upper river enters this swamp region is indicated. These maps illustrate a series of papers by Thouar, Adalberto Schmied and D. Krausse on the successive efforts to solve the mystery of the Pilcomayo, in the *Boletin* del Instituto Geográfico Argentino, Vol. 23, Nos. 1 á 12, Buenos Aires, 1909.]

ARGENTINA-CHILE. Skizze der Bahnstrecke Valparaiso-Mendoza. 1:750,000= 11.84 miles to an inch. 5 x 18 inches. *Geogr. Anzeiger,* Vol. 11, No. 5, Gotha, 1910. [Shows the route of the recently completed trans-continental railroad across the Andes, indicates the narrow gauge, cogged part of the line between Mendoza and Santa Rosa de los Andes and is accompanied by a profile of the line between the Atlantic and Pacific, with 10-fold exaggeration of the vertical scale.]

CHILE-ARGENTINA. Maps del Camino Trasandino sobre el Bouquete de Pérez Rosales. 17½ x 12¾ inches. Also profile of route between Bariloche on L. Nahuel Huapí, and Puerto Montt on the Pacific, across the Andes, with ten-fold exaggeration of the vertical scale. Illustrates paper "El Camino Trasandino sobre el Boquete de Pérez Rosales" by Dr. Franz Kühn, in Bol. del Instituto Geográfico Argentino, Vol. 23, Nos. 1-12, Buenos Aires, 1909. [Six tints and white for altitudes. Fully two-thirds of the route is by water across lakes Llanquihue, Todos los Santos and Nahuel Huapí.]

AFRICA

BELGIAN-CONGO. Carte politique du Congo Belge. 1:8,000,000=126.2 miles to an inch. 11 x 11 inches. *Le Mouvem. Géogr.,* Vol. 27, No. 21, 1910. [Shows, in colors, the twelve Districts of the Colony.]

BELGIAN CONGO-UGANDA. Le Bassin du lac Albert. 1:2,000,000=31.56 miles to an inch. 29° 10′-32° E. of Paris; 0° 30′-3° N. 5 x 5½ inches. *Le Mouvem. Géogr.,* No. 23, 1910. [Black map with paper: "Le Lac Albert."]

CAMEROONS. Karte des Konzessionsgebietes der Gesellschaft Süd-Kamerun. 1:300,000=4.73 miles to an inch. By W. Moisel. 1° 58′-3° 43′ N.; 13° 27′-15° 19′ E. 26½ x 42 inches. *Mitt. aus den Deuts. Schutzgeb.,* Vol. 23, No. 2, Berlin, 1910. [Shows commercial stations, highways, native paths, forest boundaries, etc. Large parts of the concession are uninhabited and little explored forest areas. Mr. Moisel has supplied a description of the map.]

GERMAN EAST AFRICA. Dialect Karte von Unjamwesi. Nach Mitteilungen von Missionssuperintendent R. Stern und andern Quellen bearbeitet von Bernhard Struck. 1:2,000,000=31.56 miles to an inch. 2° 15′-8° 30′ S; 29° 30′-35° E.

14 x 12 inches. *Mitt aus den Deuts. Schutzgeb.*, Vol. 23, No. 2, Berlin, 1910. [In colors, with explanatory text by Mr. Struck.]

NORTHEAST AFRICA. Carte politique de la Vallée du Nil en 1894. 1:12,000,-000=189.39 miles to an inch; 0°-31° N.; 19°-45° E. 11¼ x 9 inches *Le Mouvem. Géogr.* Vol. 27, No. 20, 1910. [In colors. Shows the itineraries of Kitchener, the Marchand mission, Dhanis and other Belgian officers and illustrates an article: "Souvenirs de Fashoda et de l'Expédition Dhanis."]

SOUTHWEST AFRICA. South West Africa. By Prof. H. H. W. Pearson. 1:2,500,000=39.46 miles to an inch. 26° 25'-34° 50' S.; 13° 35'-21° 10' E. 14⅞ x 12¼ inches. Inserts of South Africa in 1:40,000,000 and Southern Angola in scale of main map. *Geogr. Journ.* May, 1910. [Names in red across the author's route show approximately the distribution of vegetation. Illustrates paper: "The Travels of a Botanist in S. W. Africa" by Prof. Pearson.]

TOGO. Marsch des Dr. Koert längs des Mónu vom Wegübergang Agbandi-Bagu an bis nach Ssadá und die unterwegs festgestellten Goldvorkommen. 1:100,-000=1.5 mile to an inch. 18 x 3½ inches. *Mitt. aus den Deuts. Schutzgeb.*, Vol. 23, No. 2, Berlin, 1910. [Gold finds are indicated on this black map, with many notes on the geology. Illustrates paper: "Über Goldvorkommen im östlichen Togo."]

ASIA

TIBET. Das Hochland von Tibet zur Übersicht von Sven Hedins Reisen 1894-1908. 1:3,700,000=58.3 miles to an inch. 26° 10'-40° 30' N.; 76° 48'-97° 40' E. Entwurf und Terrain von H. Habenicht. Situation und Schrift von C. Barich. Inset of South England on same scale as main map. *Pet. Mitt.* Vol. 56, 2 Halbband, Heft 1, 1910. [This fine map was prepared to accompany Dr. Hedin's paper in the same number: "Die wissenschaftlichen Ergebnisse meiner Reise in Tibet, 1906-08." Dr. Hedin says in this paper: "With regard to geographical discoveries, naturally everything is new as soon as the explorer enters one of the 'white' areas. A good idea of the progress of discovery in Tibet may be gained by comparing sheet 62 in Stieler's Hand Atlas (1909) with the superior and beautiful map by Habenicht and Barich in the present number of *Petermanns Mitteilungen.* This map is, in all respects, up to date and gives, not only an excellent picture of a complicated and strongly accentuated part of the earth's surface that is very difficult to describe, but also shows very clearly what has already been done and what remains to be accomplished. The map is likely, for some time, to supersede all other maps of Tibet because it gives all the latest discoveries and it has been carried out with the greatest care and skill. It adds to our earlier data great wealth of information with regard to the distribution, size and shape of the myriad lakes of western and central Tibet. We see here the long range discovered by Ryder designated as the "Ryder-Kette," as Habenicht had suggested. The map is especially rich in the large number of determinations of heights of mountains, passes, lakes and places, a particularly prominent feature of the great work which Dr. Hedin has carried out. The mountains extending from south of Tengri-nor to and beyond the western border of Tibet, whose exploration was very far advanced by Sven Hedin, and which were named by him, Trans Himalaya, are so designated on this map, in brackets, but it seems likely that this name will be replaced by Hedin Mountains which are so indicated on this map to the west of 84° E. Long. This new map of Tibet is one of the most notable contributions to cartography of recent years.]

EUROPE

AUSTRIA-HUNGARY. Schulwandkarte des Politischen Bezirkes Horn. 1:40,000=0.6 mile to an inch. 4 sheets. 48° 30′-48° 56′ N.; 15° 22′-15° 59′ E. Herausgegeben vom k. k. Bezirksschulrate Horn. G. Freitag & Berndt, Vienna, 1909. [Eighteen black symbols and six tints are used. Contours of elevation with 20 meters interval.]

GERMANY. (a) Geologische Karte der Umgebung von Letmathe, [Westphalia]. 1:25,000=0.39 mile to an inch. 6½ x 4⅞ inches. 30 colored symbols for formations. [Illustrates: "Über eine Exkursion in das Devon u. Culmgebiet nördlich von Lethmathe," von A. Denckmann; (b) Quellmore in Masuren, [East Prussia]. 1:125,000=1.9 mile to an inch. 8⅝ x 5¼ inches. Colors. [Illustrates paper (same title) by H. Hess v. Wichdorff and P. Range]; (c) Geologische Karte des Grossen Moosbruches in Ostpreussen, bearbeitet von A. Klautzsch, 1903-05. 1:50,000=0.7 miles to an inch. 12 x 10 inches. Colors; (d) Höhenschichten Karte des Grossen Moosbruches in Ostpreussen, by A. Klautzsch. 1:50,000. 12 x 10 inches. Contours in colors with 5 meters interval. [c and d illustrate "Die geologischen Verhältnisse des Grossen Moosbruches in Ostpreussen unter Berücksichtigung der jetzigen Pflanzenbestände," by A. Klautzsch]; (e) Geologische Übersichtskarte des Hümmlings (Hannover). 1:250,000=3.95 miles to an inch. 52° 36′-53° N.; 24° 50′-25° 50′ E. 10¾ x 7¼ inches. Colors. [With paper: "Geologische Beobachtungen im Hümmling," by F. Schucht]; (f) Geologische Spezialkarte der Gegend von Ütersen u. Schulau [Schleswig-Holstein]. Nach den Spezialaufnahmen von H. Schröder u. J. Stoller. 1:25,000=0.39 mile to an inch. 14½ x 24 inches. [This map in colors illustrates paper: "Diluviale marine u. Süsswasser- Schichten bei Ütersen-Schulau," by H. Schröder and J. Stoller. *Jahrbuch* der Königil. Preussischen geologischen Landesanstalt u. Bergakademie zu Berlin, für 1906, Berlin, 1909.]

SILESIA. Schulwandkarte des Herzogtums Schlesien. 1:100,000=1.5 mile to an inch. 4 sheets. 49° 27′-50° 30′ N.; 15° 52′-19° 12′ E. Bearbeitet von Rudolf Kober, k. k. Bezirksschulinspektor. G. Freytag & Berndt, Vienna, 1909.

OCEANIA

PACIFIC OCEAN. (a) Lotungen S. M. S. "Planet," 1909. 11° 30′-21° 10′ S.; 164°-172° 40′ E. 7½ x 9 inches. (b) Lotungen S. M. S. "Planet," Juni-Okt., 1909. 4°-8° S.; 148°-155° E. 8½ x 15½ inches. *Ann. der Hydr. und Marit. Met.,* Heft 3, 1910. [Black maps with soundings and contours of depths in meters. Map a shows, mainly, work done among and near the New Hebrides; map b, soundings from New Pomerania to the northern part of the Solomon group. The soundings on both maps are supplemented by the figures of earlier data. The maps illustrated paper: "Tiefseelotungen S. M. S. Planet, 1909 unter dem Kommando von Korvetten-kapitän v. Trotha."]

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BULLETIN

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GLACIERS OF PRINCE WILLIAM SOUND AND THE SOUTHERN PART OF THE KENAI PENINSULA, ALASKA

I.—GLACIERS OF THE NORTHERN PART OF PRINCE WILLIAM SOUND*

BY

U. S. GRANT AND D. F. HIGGINS

Prince William Sound (Fig. 1) is the large body of water extending inland from the northernmost part of the Gulf of Alaska. Its many islands and lofty shores contain ample evidence, in their glacial valleys, their deep fiords, their hanging valleys, their cirques, their rounded mountains, and their morainal deposits of profound glacial action in geologically recent times. From mountains of 2,000 to 10,000 feet in height flow down ice streams to-day which are the attenuated remnants of a vast ice field which once covered the region almost completely.

Prince William Sound was known to the Russians as Chugach Gulf. It is not a sound according to the customary usage of that term, but is an extensive bay or gulf which includes many islands. Its coast line is indented by numerous long, narrow inlets or fiords and by other less regular embayments whose shores are commonly of great complexity. The whole district is a highly dissected mountain mass which has been glaciated and then partially drowned in the sea. The form of the surface and the relations of land to water

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are similar to those which exist in the well-known "inside passage" of southeastern Alaska. The coast is rugged, rocky and picturesque and in many places rises abruptly from the water's edge to heights of 1,000 to 3,000 feet. Great mountains surround Prince William Sound on its east, north, and west sides and exist also on the islands at the entrance to the sound. These mountains contain large numbers of snow fields and glaciers, and magnificent views of snow-clad peaks and ice streams may be had from steamers crossing the

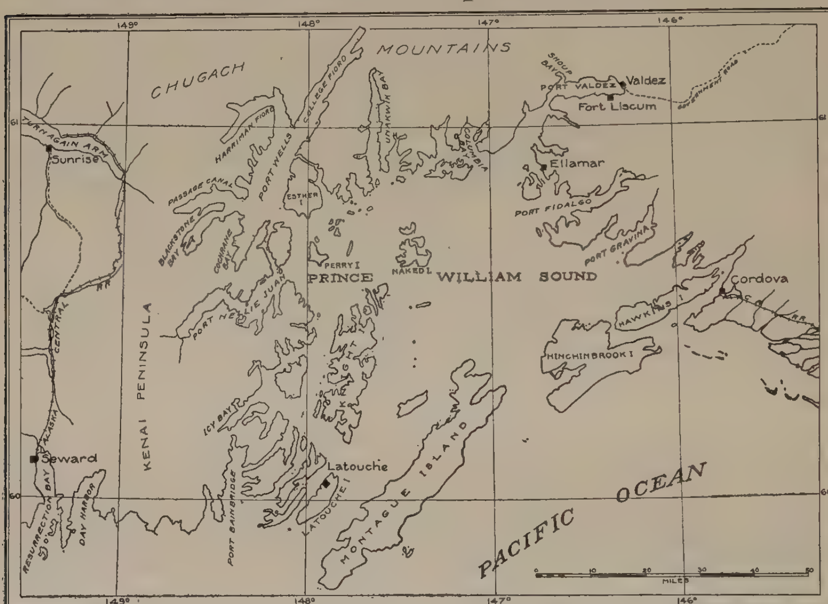

FIG. 1—Map of Prince William Sound, Alaska. Glaciers are abundant in the mountains on all sides of the sound and frequently descend to the sea in the fiords and bays of the north and west shores of the sound.

sound. In the bays and fiords of the northern and western portions glaciers frequently reach tide water and discharge their icebergs from giant ice cliffs.

Valdez Glacier

The Valdez Glacier (Figs. 2 and 3), located near the northeastern extremity of Prince William Sound, is the most noted of this district. During the spring and summer of 1898 and the early part of 1899 this glacier was used as a roadway by the horde of gold-seekers passing northward from Valdez into the Copper River and Yukon basins. The construction in 1899 of the military telegraph line and trail (followed by the development in later years of

the trail into wagon road) from Valdez northward over Thompson Pass into the Copper River basin has taken away the necessity of travel over the Valdez Glacier. The front of the glacier is covered with débris, has a low slope, and is easy of ascent, although in 1898 within the first five hundred feet of rise there were three marked benches, each about 100 feet high, over which passage was difficult. The glacier itself and the method of travel over it have been interestingly described by Schrader.*

The front of the Valdez Glacier is about four miles back of the town of Valdez (Fig. 2), where it projects out of a deep valley onto a gravel plain and shows from the town in a gently curved profile (Fig. 3). There is no forest near the front of the ice, and the present thus seems to be a period of general retreat for this glacier.

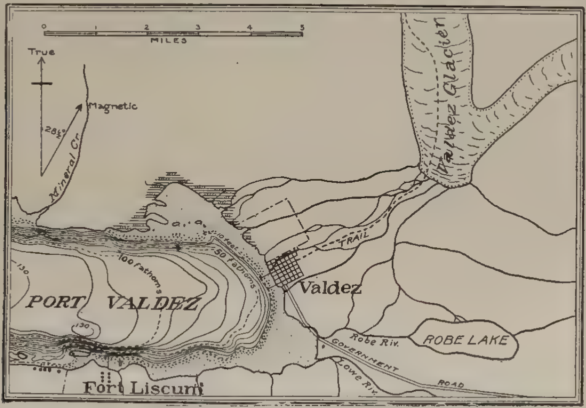

FIG. 2—Map of the head of Port Valdez and vicinity. Submarine contour lines are from data on charts of the U. S. Coast and Geodetic Survey.

There is, however, a good covering of shrubs on the valley wall near the glacial front, and close to the ice a narrow zone bare of vegetation. Thus there has been no extensive advance of the ice front beyond its present position during the twentieth century. Still oscillations of the front, as noted below, have taken place within the last few years.

We photographed the front of the Valdez Glacier in July, 1905, and the mound from which these photographs were taken was destroyed by an advance of the ice sometime before July, 1908, when we visited the glacier again and found its front about 100 feet in advance of its 1905 position. Sometime in this interval a moraine,

* Schrader, F. C. A reconnaissance of a part of Prince William Sound and the Copper River district, Alaska, in 1898: *Twentieth Ann. Rept.* U. S. Geol. Survey, Pt. 7, 1909, pp. 350–356, 365–366, 381–382.

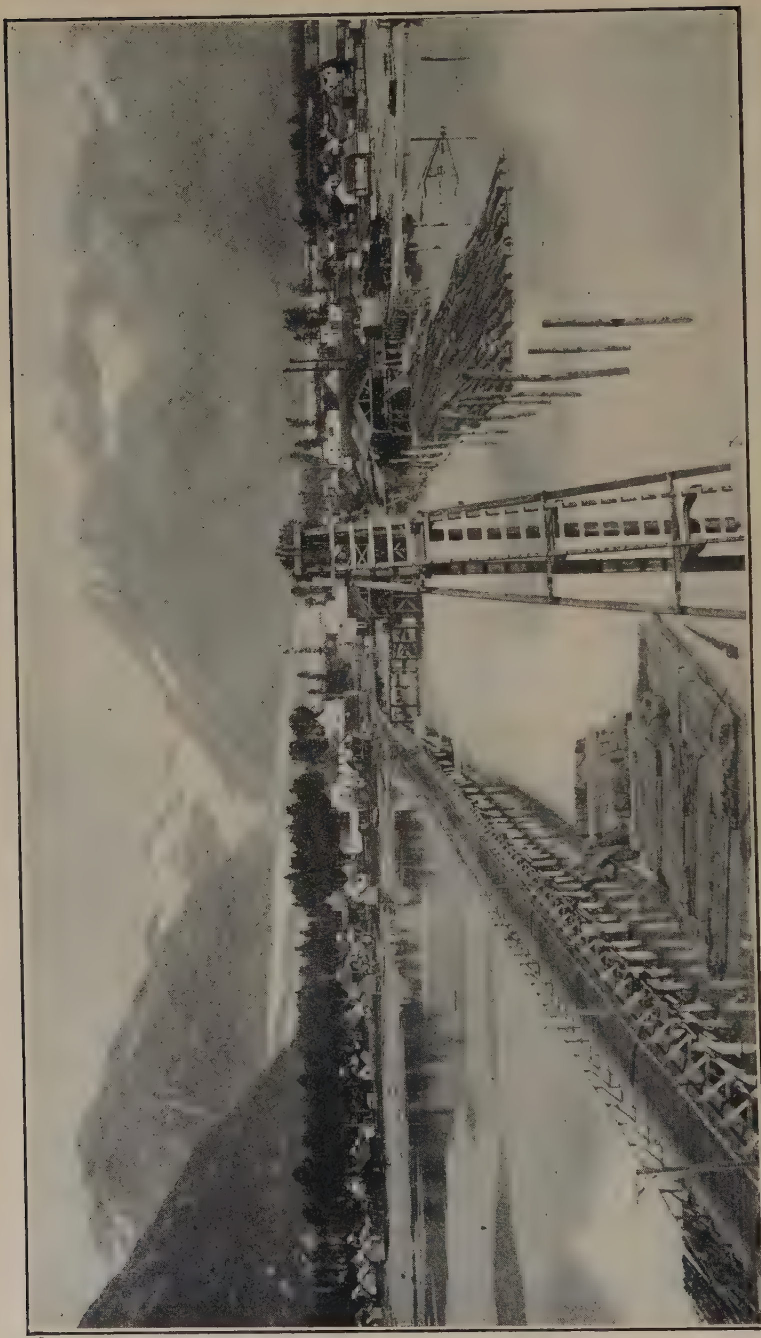

Fig. 3—Valdez and the Valdez Glacier, August, 1905. Photographed by P. S. Hunt.

10 to 30 feet in height and 25 to 125 feet wide, was deposited 250 to 300 feet in advance of the position of the front of the ice in 1905.

The plain in front of the Valdez Glacier is composed of glacial gravels deposited by the rapidly shifting and often turbulent glacial streams. Figure 4 shows these interlacing streams and the areas kept bare of vegetation by their rapid changes of courses. The white color of the streams is due to the large quantities of powdered rock, "rock flour," held in suspension. Streams from underneath

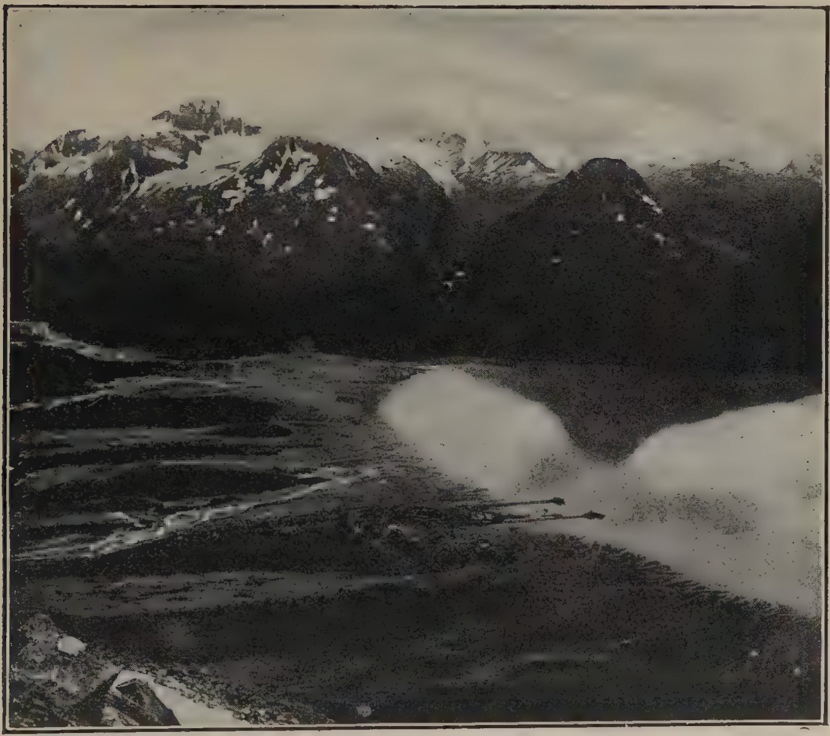

FIG. 4—Head of Port Valdez and the town of Valdez from mountain to the northwest. Photographed by G. O. Cantwell. The delta formed by Robe River and the streams from the Valdez Glacier (see Fig. 2) is gradually pushing forward into Port Valdez. Valdez is behind point shown by the two piers. Photograph taken near time of low tide.

moving glaciers always contain this finely divided solid matter. The streams are building the plain seaward, gradually filling in the deep rock trough of Port Valdez. The position of the outer ends of the wharves (Figs. 2 and 4) marks the change to the steeper submarine front of the advancing delta. The subærial slope of the plain is about 1 foot in 80, or an angle of about 40′; while the submarine

slope averages 1 foot in 5, or 12°. The rocky submarine walls of the fiord average about 24° slope or nearly 1 foot in 3, though in one place the slope is more than one to one for 750 feet. The shape of the bottom of the fiord is shown in submarine contours in Figure 2. It is a flat-bottomed trough which was cut out to a depth of 600 to 800 feet below present sea level by the huge ice stream which once filled the whole valley to a depth of nearly 4,000 feet.

It seems quite probable that occasional slumping is taking place along the seaward edge of the delta. On February 14, 1908, a considerable earthquake visited this district and broke in several places both the Seattle-Valdez and the Valdez-Seward cables which run east and west through Port Valdez. Accompanying the earthquake there seems to have been a slumping of the delta front and a consequent burying of sections of the cables. The cause of the earthquake is not known, but it is thought to have been minor faulting, for one of the cables was broken in deep water on the flat bottom of the fiord, eleven miles from Valdez. The slumping of the delta front at this time was thus probably a result rather than a cause of the earthquake.

Shoup Glacier

At the northwestern angle of Port Valdez a considerable ice tributary joined the ancient trunk glacier of the main valley. With the melting and disappearance of the larger ice stream this side glacier was separated, and it is now known as the Shoup Glacier. It serves as the perennial icehouse for Valdez and Fort Liscum, the detached bergs being lifted upon barges and taken to these towns.

We mapped (Fig. 5) and photographed the glacier on June 16th, 1909. Photographs from the same point were also taken in July, both 1905 and 1908. Its front has been practically stationary during these years, but the confused records of earlier dates make it impossible to say just what was the history of advance and retreat prior to 1905. The considerable size of the shrubs close to the front of the glacier shows, however, that there has been no appreciable advance beyond the present position for probably several decades. It is reported that the rock ledges shown in Fig. 5 were not visible in 1900 and 1901. It would require an advance from the 1909 position of only about 50 feet to cover these ledges.

The submarine contours of Shoup Bay and the adjacent part of Port Valdez as shown in Fig. 5 furnish a most interesting example of a submerged hanging valley. The bottom of Shoup Bay is more than 500 feet above the bottom of Port Valdez. The gravel bar

across the opening of the bay is an old terminal moraine formed when the front of the glacier was at the mouth of the bay. If the land were to emerge more than about 20 feet Shoup Bay would be a fresh water lake held in by the morainal dam. If the waters of

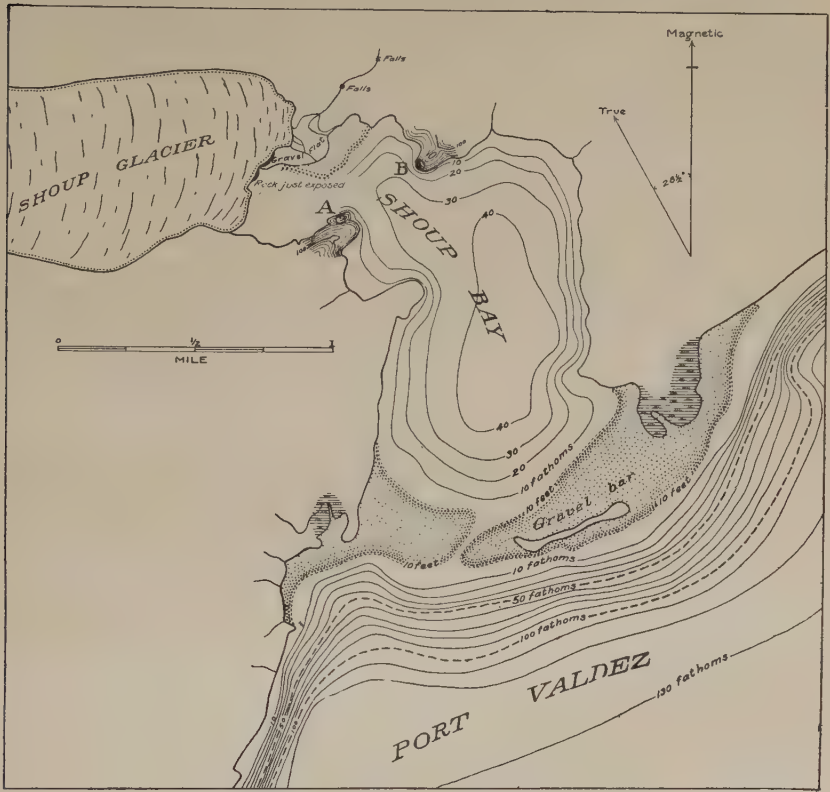

FIG. 5—Map of Shoup Glacier and vicinity, June 19, 1909. Submarine contour lines are from data on charts of the U. S. Coast and Geodetic Survey. Shoup Bay is a drowned hanging valley on the side of Port Valdez. A and B are points from which photographs of the glacier were taken in 1905, 1908 and 1909. Contour interval on land is 20 feet.

Port Valdez were to be drawn off to the extent of 300 or 400 feet the lake would then be in an ordinary hanging valley up on the side of the trough of Port Valdez.

Columbia Glacier

The most interesting and the most magnificent glacier of Prince William Sound and the Kenai Peninsula is the Columbia at the head of Columbia Bay. (See Figs. 1 and 6.) This is one of the great tide-water glaciers of Alaska and of the world, and is, moreover, easily accessible to the tourist and the lover of nature.

Heading northward into the west arm of Columbia Bay we found a line of gleaming white across the head of the bay. Approaching the glacier the white line revealed itself as a tremendous wall of ice two and a quarter miles long and 400 feet high. The booming and crashing of the ice as it broke off into the sea added

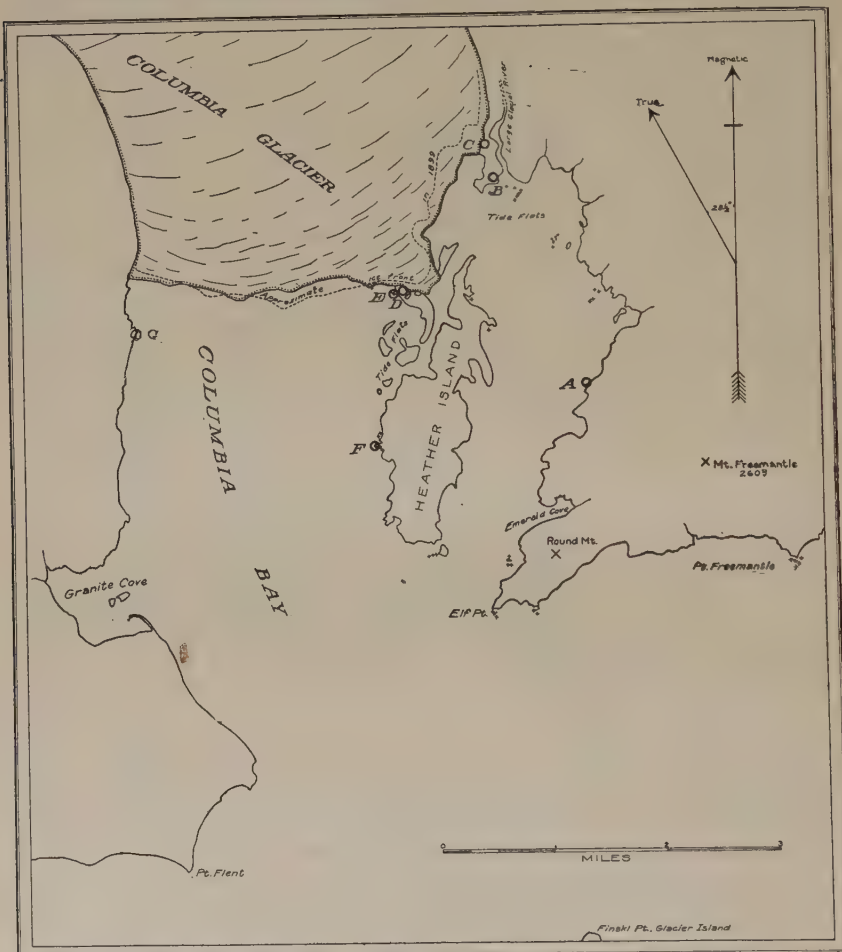

FIG. 6—Map of the front of the Columbia Glacier and vicinity, June, 1909. The points marked by circles are stations from which photographs were taken.

the last touch to make this wild and fascinating scene one never to be forgotten. Fig. 7 shows the ice wall at a distance of about a mile, with the Columbia Nunatak in the background. Even the intrepid photographer did not dare to go nearer to the jaws of this giant, for the waves caused by the falling of the ice made close ap-

proach in small boats exceedingly dangerous. Small pieces of ice falling from the ice face strike the water with a sound like the snap of a rifle, while larger pieces descend with the roar of thunder, sometimes throwing the water to the height of the ice cliff. The waves generated by these ice blocks cause havoc on the adjoining shores far above the height here reached by the greatest storm waves.

In 1899 the Harriman Alaska Expedition visited this glacier and Gilbert* wrote an excellent description of it at that date. At the western edge of the glacial front Gilbert's description and photograph show a bare zone between the forest and the ice of from 200 to 300 feet in width. This locality was not examined by us in 1905 and 1908. In 1909, however, the glacier had advanced sufficiently to cover the entire bare zone and to encroach upon the forest itself. The forest is now being attacked by the ice and considerable havoc has been done by the streams along the side of the glacier and by waves caused by the fall of icebergs. We estimate that the ice at its western edge is now (1909) 500 feet in advance of its position in 1899, and that this advance has taken place, in the main, since July, 1908.

At the east edge of the glacier a swift muddy stream of considerable size enters the bay. The tongue of land between stations B and C of Fig. 6 is a sharply rolling grassy stretch. Fig. 8 shows the view from station B looking southwest. Here is a beautiful example of knob and kettle topography developed a few decades ago. The clump of trees in the left middle ground is a tiny remnant of the forest which covered all this land before the ice invasion. The largest spruce trees on the new topography are about six inches in diameter, and they are perhaps twenty years of age. But since our observations lead us to believe that vegetation gains a foothold very slowly on new glacial soil in this region of Alaska, we estimate the date of this advance at about fifty years ago. This is the earliest position of the front of which we have record since the growth of the present forest.

Morainal deposits at the north end of Heather Island, however, contain many fragments of shells of pelecypods and gasteropods which seem to be of recent species. It is improbable that these forms live in the cold milky waters near the melting ice, and so the presence of their remains in the recently deposited drift would indicate that the ice front was, in geologically recent time, considerably farther north than at present. The head of the north end of the

* Gilbert, G. K. "Harriman Alaska Expedition," Vol. 3, 1904, pp. 71-81.

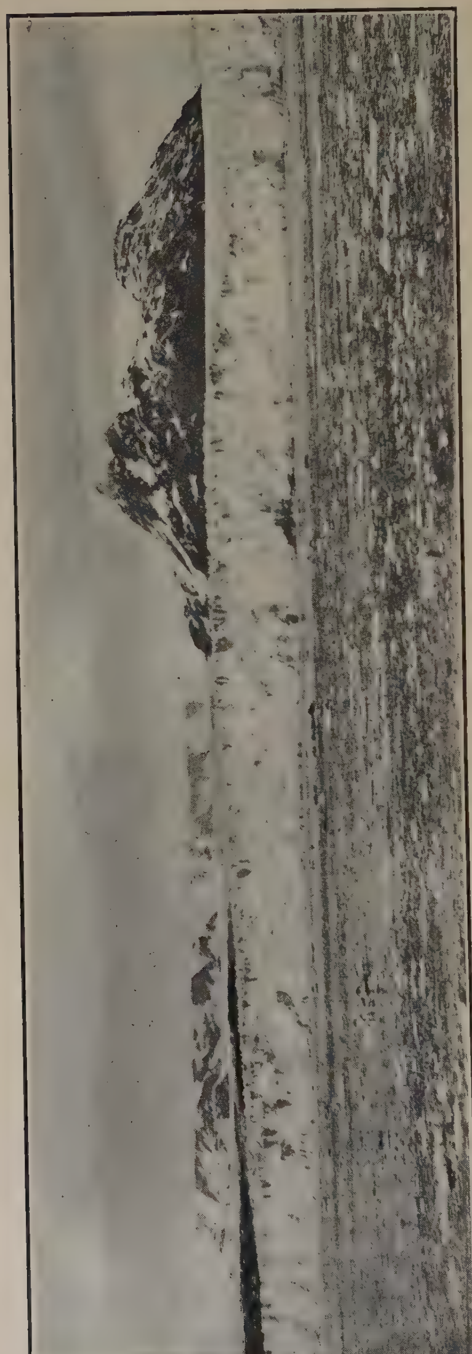

FIG. 7—Front of the Columbia Glacier and the nunatak. Photographed by P. S. Hunt.

eastern part of Columbia Bay is shallow and it is possible that a retreat of the ice front of not more than a mile might have exposed ground above tide water so shaped that the drainage from the eastern part of the glacier would have been diverted to the westward, leaving the eastern portion of Columbia Bay free of glacial waters. This condition would be favorable to the growth of molluscan life.

It was on the largest of the small islands northwest of Heather Island, however, that we found the most interesting features of the Columbia Glacier. It was here, at station D (Fig. 6), that photographs have been taken from practically the same point five times

FIG. 8—Front of the Columbia Glacier from Point B (Fig. 6), June, 1909. At the left is the remnant of the forest destroyed by the advance of the glacier perhaps fifty years ago, and the morainic topography of the foreground was developed at or very shortly after the same date.

in an interval of ten years. Gilbert's photograph, taken June 26th, 1899, is here reproduced as Fig. 9, and our view, taken June 24th, 1909, is Fig. 10. The same trees and rocks can readily be recognized in each. The man standing on the small push moraine in Fig. 9 is Mr. W. A. Dickey, of Landlocked Bay, Prince William Sound. His place, in the later view, has been overrun by a few feet of ice.

Although the ice shows in both these photographs, the front was well out of view in July, 1905, to the north (left); and in July, 1908, it was just in the edge of the picture. Briefly, the history here

FIG. 9—Front of the Columbia Glacier and overturned forest, 1899. Photographed by G. K. Gilbert.

FIG. 10—Front of the Columbia Glacier and overturned forest, 1909. Photographed from the same station (D in Fig. 6) as Fig. 9. In the ten years between the dates of the two photographs much grass has grown in the foreground. In the last year the glacier has advanced, destroyed some of the trees and pushed forward others (especially the nearly erect, dead, almost branchless, tall tree on the right).

recorded is as follows: At a date estimated as 1894 the large push moraine which contains the bare dead trees and the tilted living trees was formed. We infer a still earlier advance, however, for the bare, dead trees had undoubtedly been killed before the pushing up of this moraine. Then there was a retreat an unknown distance, followed by an advance to form the small push moraine on which Mr. Dickey stood. In 1899 the distance from the small moraine to the ice was found to be 60 feet. In 1905 the ice was 220 feet north of the small moraine, but in 1908 it had advanced 100 feet. Between July 15th, 1908, and June 24th, 1909, the ice pushed forward 310 feet, and by August 23rd, 1909, as observed by Tarr and Martin, it was seventy feet (estimated) farther out and 120 feet ahead of its former (1894) maximum. Between the last two dates there was then an average rate of advance of the front of 1.17 feet per day. The actual rate of movement of the ice was considerably greater than this, for melting was at its maximum during this period.

The photographs (Figs. 9 and 10) are also of interest in showing the growth of vegetation on a freshly exposed till surface. In the first year or two no vegetation had gained a foothold. In the next six years very little grass had started to grow, though considerable fire weed (*Epilobium*), which is one of the first plants to cover the ground recently bared by ice, was much in evidence in the outer part of the bare zone. In 1909 the ground was well covered by grass, but no trees nor shrubs had put in their appearance. A number of tilted trees which were alive in 1899 had died by 1905 and still others by 1909. The dropping of twigs and bark from the dead trees, and the general decay of the trunks, progressed comparatively little between 1899 and 1909. The impression which we gathered from our visits to several such areas of forest invaded by ice and of ground recently bared is that the time since the ice invasion is very likely to be underestimated. Were it not for the evidence of dated photographs, an examination of this locality in 1909 very likely would have convinced us that the former maximum of the ice was four or five years ago rather than fifteen or more years ago.

Figs. 11 and 12 portray graphically the movement of the ice front between 1908 and 1909. The tree showing faintly at the extreme left of Fig. 11 is the lower (dead) tree in Fig. 12.

Nothing could give a more impressive illustration of the tremendous force in the moving ice than the uprooted trees and folded layers of peaty soil on this little island. No motion was visible, and an occasional snap of an overstrained piece of wood was all that

gave evidence of active movement. In the advance of the ice, in 1909, into the previously disturbed forest some of the trees were pushed forward bodily without being overturned, although their inclinations were sometimes changed. One such tree had its position changed by 100 feet by June 24, 1909, and by Aug. 23 of the same year it had been moved further, but was still nearly upright.

FIG. 11—Front of the Columbia Glacier, 1908.

FIG. 12—Front of the Columbia Glacier, 1909. This photograph was taken from nearly the same position as Fig. 11. The lowest dead tree is the same as the one shown at the extreme left of Fig. 11.

The almost erect, dead, nearly branchless tree shown on the right in Fig. 9 has been pushed forward and can easily be recognized in Fig. 10. At the west edge of this island we found one of the most forcible visual evidences of the glacier's strength. Here the ice was literally plowing up the beach gravels into a ridge 25 feet high (Fig. 13), and such an example of titanic and silent force could not but arouse feelings of awe and of profound respect for the white giant.

FIG. 13—Push moraine 25 feet high at front of Columbia Glacier.

FIG. 14—Our launch anchored to an iceberg off the Columbia Glacier.

Meares Glacier

The Meares Glacier is situated at the head of the fiord-like northern part of Unakwik Inlet (Figs. 1, 15, and 16). We named it after Captain John Meares, one of the early explorers of Prince William Sound (1786). We know of no other information than that here noted concerning this glacier, except that Fidalgo in 1790 and probably also Vancouver in 1794 visited Unakwik Inlet and reported that the upper end was blocked by ice. They noted the noise of the falling ice, and we also observed that even to-day the

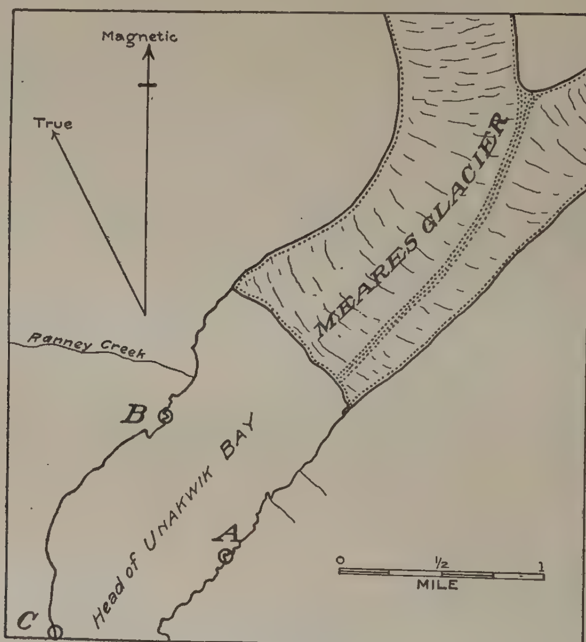

Fig. 15—Sketch map of front of Meares Glacier and vicinity, June 1909. The points marked by circles are stations from which photographs were taken.

boom of the ice breaking from the front reverberates impressively between the steep mountain walls of the bay.

In Aug., 1905, a hurried visit to the glacier was made, but the exhaustion of the supply of films prevented the securing of photographic records. On June 26th, 1909, we went up to the head of the bay and mapped and photographed the front. Fig. 16 is the view from station C of Fig. 15. The front of the glacier is four-fifths of a mile wide and at least 300 feet high. The waves caused by huge falling fragments of ice made it unsafe for us to approach closer to the ice than three-quarters of a mile in our dory.

FIG. 16—Front of the Meares Glacier, June, 1909. Photographed from Point C, Fig. 15.

In 1905 the bushes and trees were close to the ice and there was no bare zone, or at most a very narrow one, visible between the ice and the forest. In 1909 the front of the ice seemed to be a little in advance of its position of four years before. At the later date near the front of the glacier on the south side was a brown zone estimated to be 200 feet in width. This brown zone appeared to have been caused by dead vegetation rather than by bare rock, and at the edge of the ice there were a few small trees. Close to the glacier there was a sparse forest which contained trees estimated to be ten inches in diameter. Hence the ice was probably as far forward in 1909 as it has been during the last hundred years or more.

Two glaciers join about two miles back from the front to form the main body of the Meares Glacier, and a small medial moraine extends seaward from the point of junction. The ice stream from the north is the larger of the two small streams, and it probably comes from a snow-field which discharges northward also into the Yale Glacier of Port Wells. The front of the Meares glacier is a clear white wall of ice with delicate blue shadows, and although it is not as large as several other glaciers of Prince William Sound, it is, nevertheless, one of the most beautiful.

LOCATION OF THE TOWNS AND CITIES OF CENTRAL NEW YORK

BY

RALPH S. TARR

Larger Geographic Features. The largest geographic province in the State of New York is a hilly plateau (Fig. 1), the northern portion of the Appalachian plateau which skirts the western base of the Appalachian mountains. This plateau extends northeastward to the Hudson River, where it is known as the Catskill mountains; thence it stretches westward to the western boundary of the State and southward into Pennsylvania. To the north of the plateau, in eastern New York, rise the Adirondack mountains, with the valley of the Mohawk River forming a broad depression between the Adirondacks on the north and the plateau on the south. In central and western New York the plateau is terminated on the north by a more or less perfectly developed escarpment, beyond which, to the north, lies a plain of very level character which extends to the shores

of Lake Ontario. Further west is a still narrower plain between the escarpment and Lake Erie.

THE HIGHWAYS. These geographic features, and others, have had an important influence on the growth and development of the State as a whole. The fact that the Hudson valley, submerged to admit the sea, crosses the northern extension of the Appalachian mountains, has opened a highway toward the interior, which is continued westward by the Mohawk valley until the rugged plateau is crossed and the level lake plains reached. From the Canadian line to the southern tip of the Appalachians, in Alabama, there is no similar highway across the mountain and plateau barrier which lies between the seacoast and the fertile plains of the Mississippi valley.

It is well known how very important this highway toward the interior has become, first by the building of the Erie Canal, then by the construction of trunk railways. This has come to be one of the great routes of commerce in the world; and it has not merely led to the growth of the metropolis of New York on one end and Buffalo on the other, but has affected the whole State and has exercised a profound influence on the development of the country to the west. This highway will not, however, have attained its full degree of usefulness until it is possible for boats starting from Duluth and Chicago to freely pass over it and out to sea. Perhaps it will be not until the wisely planned works of the Canadians have begun to produce their inevitable economic effects on our own country that people in general will awaken to the truth of this statement; but I have faith that ultimately there will be full recognition of the fact that there is here a geographic invitation to reap great profit at relatively small expense. The invitation was early seen and accepted, in a way suitable to the times; but there has been no Governor Clinton of late.

Besides the dominant Hudson-Mohawk-Great Lakes Highway (Fig. 1, c d), there is a highway of secondary importance along the Susquehanna valley in southern New York (Fig. 1, a b). The Susquehanna is one of the few Appalachian rivers that heads in the Appalachian plateau and then flows across the entire mountain area to the Atlantic. It heads far back in the plateau, but not far enough to offer a complete passage, and in this respect is inferior in value to the Mohawk. Moreover, it empties into the sea many miles to the south of New York, and for that reason, also, it offers a much less inviting route for products from central New York than the shorter route via the Mohawk. As a route for products from the interior plains to the ports of Philadelphia or Baltimore the Susque-

hanna is distinctly inferior to other routes across the mountains further south.

For these reasons the Susquehanna route has never attained high importance; but parts of the valley across the mountains and plateau have been utilized by railways which have chosen a route across country, from New York to Buffalo, in competition with the Hudson-Mohawk route. Thus the Erie, Lehigh Valley and Lackawanna railways, crossing the mountains by winding courses with heavy grades, descend into the Susquehanna valley and then follow it for a portion of its course in their way across the plateau, each route diverging from the Susquehanna into some cross route leading toward the lake plains. Thus in New York the Susquehanna valley is a highway of some importance, but in no respect equal to the Mohawk-Hudson highway.

Inherent Resources. The three larger geographic provinces within the State whose influence affects the growth and development of the region under consideration,—the Adirondacks, the plateaus, and the lake plains—vary greatly in the amount and kind of contribution toward the growth of industrial centers. In each of the provinces there is water power of greater or less value; in each there is some mineral wealth; in each there is agriculture; and in each there is lumber; but in each the relative value of these resources varies greatly. There is most water power in the Adirondacks where it is least needed and least used; there is least in the plains where it would be most useful. There is much lumber in the Adirondacks and also a great quantity in the hilly plateau, but little on the plains. The mineral wealth includes building stones, clay, cement materials, salt and iron, besides mineral products of lesser value. The first three are widely distributed; the salt is confined to the central part, in the plateau and on its northern edge; and the greatest amount of iron comes from the Adirondacks.

The Adirondack province is the region of greatest economic poverty, for much of it is a forest-covered wilderness, the home of the lumberman, and in summer of the sportsman and the summer visitor. There is little agriculture, for most of the surface is too rugged and the soil too thin. The lake plains, with a level surface, a deep, fertile soil, and a genial climate modified by the presence of the large bodies of lake water, form an agricultural belt of great productiveness and the seat of a prosperous farming community. In the plateau country, too, there is much agriculture, but it varies greatly in kind and value from place to place. Toward the north, where the plateau surface is lower and more level, there is extensive

and profitable farming; and the larger valleys are the seats of prosperous farms. But in the upland, as a general proposition, farming is far less successful. Although there are many small areas of fertility, and individual farms quite equal in value to some of those in the valleys, in the main, the plateau region is not adapted to the highest grade of agriculture. There are extensive areas too steep for crops and others with a soil too thin for successful cultivation. Much of the area is in forest, and still more in pasture; dairying and sheep raising are prominent industries; markets are often remote and difficult to reach over bad roads and steep grades; and for several decades farming in the plateau region has been on the decline and the rural population has been decreasing.

Contributing Resources. Fortunately, this region does not have to depend upon its own inherent resources, for, being on or closely in touch with the great highways mentioned above, it easily receives resources which other sections are able to contribute out of their abundance. Of these resources none are more important than the coal from Pennsylvania. The Lackawanna and Lehigh Valley railroads cross the anthracite fields on their way between New York and Buffalo; and other roads tap the bituminous coal fields further west. In seeking an outlet for this coal, railroads reach out to the Erie Canal route and to the Great Lakes as well as to the seacoast, and those railroads wind their way across the plateau of central New York. Much of the industrial development of the valley towns of the plateau region, as well as of those along the Erie Canal, depends upon the coal thus brought to them; and the towns on the way are further influenced by the transportation facilities that the coal-carrying roads furnish. It is safe to say that there would be not only fewer but far less important railroads through the sparsely settled plateau region of central New York if the coal carrying trade had not encouraged their construction.

The dispersion of products, upon which successful manufacturing depends, is thus well provided for in the greater part of the plateau region (Fig. 1). From its own resources the plateau country could hardly have invited such extensive railway construction; but being crossed by two important highways from seacoast to interior, and having extensive coal fields on the southern side seeking outlet to the northern highway, the more important valleys are threaded by lines of railway. Since these cross lines connect on the northern end with the Great Lakes and the Mohawk-Hudson highway, they make the regions that these routes connect indirectly tributary to the needs of the valley towns of the central New York plateau.

CROSS ROUTES. Thus, in addition to the two great highways there are numerous cross routes, or byways (Fig. 1). Like the highways, these are dependent upon physiographic conditions. In a word, they are stream-made valleys cut in the plateau and modified, in one way or another, by glacial action. Along these valleys roads and railroads have been built. To understand the nature of these cross routes calls for a brief description of the plateau region.

It is a broad area of nearly horizontal strata, with the upland rising from 1,500 to 2,000 feet above sea level. Long-continued denudation has greatly dissected the plateau, giving rise to a mature topography, with broad, deep valleys and undulating hill tops rising to a fairly uniform level. Looking across country from the crest of one of the upland hill tops, the appearance is that of a plain; but from the valleys one sees steep slopes and a hilly country; and a journey across country confirms the latter impression, for one must go up and down hill and across a succession of broad, deep valleys in any such journey (Fig. 1).

While the plateau region is a stream-dissected country in the main, it has received profound and important modification as a result of glacial action. Glacial erosion has broadened and deepened many of the valleys, especially those extending north and south in the direction of ice flow, like those occupied by the Finger Lakes. Such erosion has lowered the bottoms of some of the valleys even below sea level, and in the basins thus produced, and in part behind dams of glacial drift, long finger-like lakes have been formed.

Glacial erosion has worked laterally, as well as vertically, steepening the valley slopes here and there, often making them so precipitous that the forest alone grows upon them. The steepened slopes of the larger valleys, such as Cayuga and Seneca (Figs. 4 and 7), terminate on the upper side at a fairly uniform level at which the tributary streams enter, hanging high above the valley bottom. These *hanging valleys* have moderate grade above this level, but their water is precipitated down the steepened slope of the main valley in a series of cascades, in picturesque gorges, furnishing water power at a number of places.

Ice erosion has introduced modifications in the topography in still a third, and even more important way. As the ice swept across the divides of the preglacial streams, perched high up in the plateau, it scoured them down, thus greatly decreasing the grades from one valley to the other. In many cases the divides between streams flowing north and south were worn entirely away and the two opposing valleys united into a single *through valley* (Figs. 1, 2, 3, and 4),

graded up more or less by glacial deposit. After the glacier disappeared many streams in valleys that in preglacial time sloped northward and shed their waters into the St. Lawrence system, were now so united with south sloping valleys that the waters flowed into the Susquehanna system. In this way the headwaters of the Susquehanna have received notable accessions robbed from the St. Lawrence drainage area. The through valleys have also been straightened and widened by lateral ice erosion, cutting off the overlapping spurs.

The newly established grades of the through valleys, made by glacial erosion and deposit, have opened up many gaps across the plateau, and these the railroads follow. Had it not been for this modification of the topography by ice action we may be sure that railroad building in the plateau region would have been far more difficult than now, and many of the present railways would have been quite impossible because of the heavy grades up to divides and the need of tunnels on the way. Under present conditions the passage of the plateau is easy, especially along the through valleys at the southern ends of the valleys of the Finger Lakes.

These through valleys form the leading cross routes, or byways, between the Susquehanna and Mohawk-Great Lakes highways (Figs. 1-4). They are rendered still more important by the deep, long, narrow lakes which occupy a part of their course and are useful for navigation. The two largest of these lakes, Cayuga and Seneca, are united by canal with the Erie Canal; but at present the traffic by rail from north to south across the plateau province is of much more importance than that by water.

There are no cross routes in the plateau province in an east and west direction, because the glacier eroded only the divides between north and south flowing streams. To go by rail from Ithaca to Watkins, for example, a distance of about 20 miles in an east-west direction, one must go south, then west, then north, travelling around three sides of a quadrangle (Fig. 1). Similar roundabout journeys are necessary between most points lying on an east-west line; but railway travel north and south is much more simple and direct.

Cities on the Northern Highway. Along the Hudson-Mohawk-Great Lakes Highway, from New York City to Buffalo, there is a succession of villages, towns and cities closely spaced along the entire route. The importance of this transportation route is indicated most clearly by the size and growth of the two cities at its end—Buffalo, where it touches the Great Lakes, and New York City, where it touches the sea. Naturally, these are the two largest cities of the State, because of their location at the two ends

of the leading highway. Naturally, also, the cities next in size in the State are at favorable points on this same great highway.

Next in size to Buffalo is Rochester on the Erie Canal and New York Central Railway at a point where the highway is crossed by the Genesee River, which here tumbles in great falls, furnishing water power of great value. The city lies in the midst of a fertile agricultural region; it is near enough to Lake Ontario to benefit from the shipping on that large water body through its port Charlotte; and it is at the point of junction of routes from the broad and fertile upper Genesee valley with the east-west highway.

Ranking next to Rochester is Syracuse, less favorably situated and to-day profiting little from the cause which led to its foundation and early growth. Salt making is practically an industry of the past in Syracuse, though salt waters which are led from the plateau region to the south to the suburb Solway sustain a thriving industry there. Toward Syracuse from the south lead three through valleys which, uniting north of Cortland, are continued southward by a continuous through valley to Binghamton (Fig. 1). This is one of the most important north-south cross routes in central New York and it extends northward to the lake port of Oswego. The fact that Syracuse is situated at the point where this cross route intersects the great east-west highway is one of the factors in the growth of the city. The cross route unites Syracuse with the anthracite fields, as the east-west highway connects it with the sea and the Great Lakes.

Next in size among the cities of New York are Albany and Troy, both practically at the point where the Mohawk from the west unites with the Hudson from the north; and after these cities come Utica and Yonkers, the former at the head of the Mohawk, the latter just above New York City. All four of these cities lie outside the area with which this paper is immediately concerned. Many smaller cities, towns and villages lie along the highway between New York and Buffalo, all dependent upon the facilities of transportation which the highway offers, and most of them further influenced by the convergence of cross routes toward their site, or by some other favorable geographic condition.

CITIES ON THE SOUTHERN HIGHWAY. Among the cities of New York the ones next in size to those mentioned are located on the Susquehanna-Chemung highway. These are Binghamton and Elmira (Figs. 1 and 2), to which also should be added Sayre in Pennsylvania, just across the southern boundary line of New York. Waverly in New York is practically one of the outskirts of Sayre.

FIG. 2—Photograph of a part of the U. S. Geological Survey topographic map, showing the location of Binghamton (B) and Owego (O) on the southern highway.

Each of these cities depends for its growth upon the convergence of cross routes upon the southern highway. Binghamton (Fig. 2), on the Susquehanna, is at the point where the Chenango River enters, and it is along this valley that the cross route to Syracuse runs, as well as one northeastward to Utica, and still a third, diverging from the second and rejoining the Susquehanna higher up, leading toward Albany.

Sayre lies where the Susquehanna turns southward, at the junction of the Chemung, and at the point where a through valley enters, which, branching at Van Etten, opens routes to both the Seneca and Cayuga valleys. The Lehigh Valley Railroad, coming up the Susquehanna, enters this through valley and, by easy grade, continues along the Seneca valley on its way across the plateau toward Buffalo; and a branch line diverging from it at Van Etten follows the Cayuga valley, reuniting with the main line at the lower end of Seneca lake.

The Lackawanna and Erie railways, coming down the Susquehanna from above Binghamton, enter the Chemung valley at Sayre and pass up it through Elmira (Fig. 1). Another through valley, leading southward from the Seneca valley toward Elmira, is followed by two lines of railway; another railway enters Elmira from the south, and a third, by a difficult route, over a part of the plateau, from the northeast.

The influence of the convergence of highways on the growth of centers of population in this hilly country is further illustrated by several smaller places in the Susquehanna valley, which is deeply sunk in the plateau. For example, Union lies at the mouth of Nanticoke Creek; Owego at the mouth of Owego Creek; and an examination of the U. S. Geological Survey topographic map will show still other instances.

In such a hilly country it follows, of necessity, that the chief travel and transportation must be along the valleys, and, consequently, that the points of their convergence will become centers of industry and population roughly proportionate in importance to the volume of trade carried along the routes. These points of convergence become junctions and places of transfer; and they become handlers, manufacturers and distributors of the products contributed by the converging highways. That the towns and cities at these points are no larger is due primarily to the fact that they lie in a region of limited resources, having little material to contribute for manufacture and distribution, and in a region of sparse population demanding little from abroad or from local manufactories.

That the larger centers of population along the southern highway are smaller than those along the northern highway is due partly to the fact that the surrounding country is less prosperous and productive, partly to the fact that the highway is secondary in importance as a through route, and partly to the fact that this route cannot contribute the same variety of resources from outside, at the same expense, as can be done along the northern highway. That the cities have attained even their present size is in no small degree due to the fact that they lie near to the coal fields and are reached by leading coal carrying roads.

THE CROSS ROUTE CITIES. It would be tedious to consider these routes one after the other. All the cities and most of the towns and larger villages between the northern and southern highways lie along the cross routes, and the causes for their location fall into a few categories which can easily be stated in a consideration of the two types of cross routes:—(1) the continuous through valley; (2) the through valley with a lake at one end.

Of the former the cross route from Binghamton to Syracuse may be considered as typical (Fig. 1). For the greater part of its length this route lies in a narrow valley deeply set in the plateau and bordered by steeply rising sides. The narrow floodplain is closely farmed, where not too wet; and where not too steep the valley slopes are also cultivated, though less successfully. Farms occupy the upland on either side, but the population is sparse and decreasing. A railway line joining the southern and northern highways follows this cross route.

Here and there side valleys enter, and along most of them roads descend from the upland. Groups of houses and small villages are commonly found in the main valley at such points; or, if the entering valley is large, opening up a larger area of tributary country, there may be a good-sized village. Here and there a creamery, or a grist mill may be seen manufacturing local products, and in some cases making use of water power of a stream descending swiftly from the upland, or of some low fall in the main stream itself. Occasionally there is a small manufacturing plant which depends upon the outside for both its fuel and its raw material.

At only one point in all the distance between Binghamton and Syracuse is there any notable concentration of population. This is at Cortland, which is located in the most favorable situation along the entire route (Fig. 3). In the first place, it lies about midway between Binghamton and Syracuse and is thus able to serve a large area of surrounding country that is beyond the easy reach of these

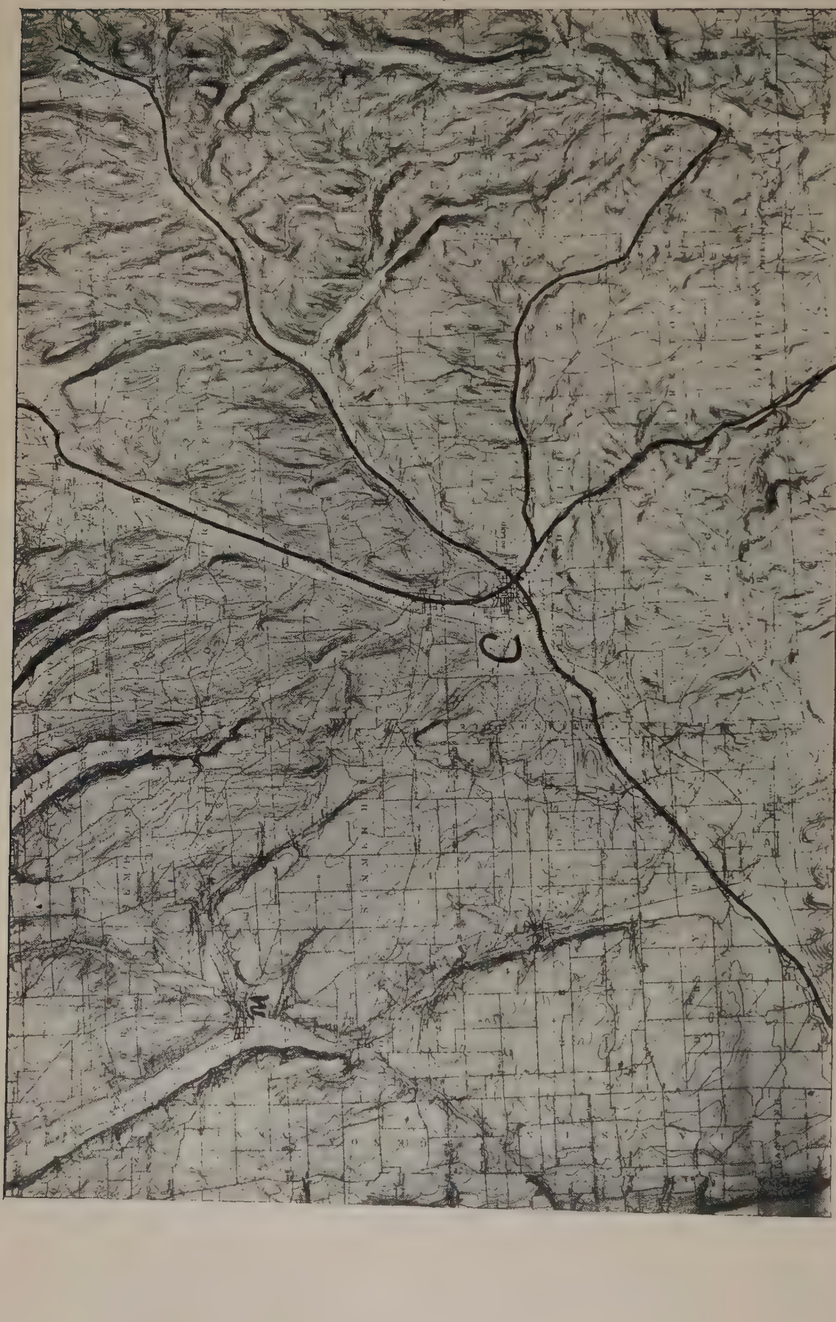

Fig. 3—Photograph of a part of the U. S. Geological Survey topographic map showing location of Cortland (C) and the railways (heavy black lines) converging on that center. M, Moravia.

two cities. But far more important than this is the fact that it is situated at the most extensive convergence of highways in the central part of the plateau region. Six valleys radiate from this center, and along five of them railways run. In consequence of its favorable situation, Cortland has grown rapidly and has become one of the leading manufacturing centers in the plateau region.

The Seneca and Cayuga cross routes may be taken as typical examples of the second class of cross routes (Figs. 1, 4, and 7). Toward each of the lakes through valleys converge from the south, connecting them with the Susquehanna highway, while the lakes themselves extend almost up to the northern highway. Two such through valleys converge toward each of the lakes, one from Owego and one from Sayre toward the Cayuga valley, and one from Sayre and one from Elmira toward the Seneca valley. Along these through valleys south of the lakes the conditions are quite like those in the cross route already described; but in the part of the route occupied by the lakes the conditions are quite different.

LAKE HEAD TOWNS. There is a town at the head of each of the lakes: Ithaca at the head of Cayuga Lake and Watkins at the head of Seneca Lake (Figs. 1 and 4). Each of these owes its location to the shipping facilities on the lake, each of which, stretching northward for about 40 miles, is united with the Erie Canal by a short branch canal. Although Seneca Lake is slightly larger than Cayuga, Watkins is much smaller than Ithaca. The fact that Cornell University is at Ithaca partly accounts for the difference in size, but even aside from this there are excellent reasons of a geographic nature which encourage the growth of a larger city at the head of Cayuga Lake.

In the first place, all the people at the head of Cayuga Lake are concentrated in one city (Fig. 5), while near the head of Seneca Lake there are two centers to divide the population. Less than three miles south of Watkins is Montour Falls (Fig. 6), whose location depends, first, on water power and, secondly, on the fact that valleys from the southwest and southeast converge toward this point instead of toward Watkins. The lower steepened valley slopes are too steep here for railroads to descend to Montour Falls from the hanging valleys along which they approach the Seneca valley, but wagon roads descend at this point so that at Montour Falls an east-west route intersects the north-south cross route.

A second reason for the larger size of Ithaca is the fact that there is a much more perfect convergence of highways there (Fig. 1). To the north is the lake valley; to the south the through valley leading

to Sayre; to the southeast the through valley leading to Owego; to the northeast the through valley leading to Cortland and Syracuse, or, by a branch through valley to Auburn. Along each of these routes a railway runs. A third geographic condition favoring the greater size of Ithaca is the fact that it is on the most direct coal route from the anthracite fields to the northern highway. One of the first roads for the distribution of anthracite was built to Ithaca, whence the coal was sent by boat down the lake to the Erie Canal. The increase in the use of railroads for this purpose, and the decline in the relative usefulness of the canal, long ago diverted the coal traffic that promised to center on Ithaca; but this factor had much influence on the early growth of Ithaca and is still of some importance.

A factor seriously interfering with the growth of Ithaca is the character of the converging valleys. The one from the south, leading toward Sayre, is not a perfectly developed through valley, for its divide, though greatly lowered, was not completely erased by glacial erosion and deposit. Accordingly, there is a heavy grade between Ithaca and the divide; and on leaving Ithaca for the north the railway must again climb out of the valley, ascending the steepened slope by a heavy grade. It was the presence of these grades that led the Lehigh Valley Railway Company to adopt the Seneca route for its main double-tracked road, leaving Ithaca side-tracked on a branch line. The through valleys from the southeast and northeast approach Ithaca high above the Cayuga valley bottom and terminate as broadly open hanging valleys on the upper edge of the steepened main valley slope. This condition has seriously affected the railway approach to Ithaca. One line from the south descends the steepened valley slope to the level of Ithaca by a switchback (Fig. 5); the other keeps up in the hanging valley and, swinging off at right angles, passes on to the northeast along the other hanging valley, not descending to the town at all (Fig. 5). It is on the plateau where the hanging valleys terminate on the steepened slope that Cornell University is situated.

The influence of the approach of through valleys to the main valley, together with their termination high up above the valley bottom, from which they are separated by the steepened slope, has had an even more serious effect on Watkins than on Ithaca (Fig. 6). Thus the main line of the Lehigh Valley Railway keeps up above the edge of the steepened slope and the station for Watkins is three miles from the town; while the Fall Brook branch of the New York Central has its Watkins station a mile from the town; and in each case the station is over 500 feet above the town (Figs. 4 and 6).

FIG. 4—Photograph of the U. S. Geological Survey topographic map, showing lake head towns, and location of Ithaca (I), Watkins (W) and Hammondsport (H). (1) Keuka Lake; (2) Seneca Lake; (3) Cayuga Lake.

Both of these lines are double-tracked railways, one tapping the anthracite, the other the bituminous coal fields; but because of the peculiar topography their influence on Watkins is very slight.

There are lake head towns at or near the heads of the other larger Finger Lakes,—Naples near the head of Canandaigua Lake, Hammondsport at the head of Keuka Lake, and Moravia near the head of Owasco Lake; but there are no towns at or near the heads of Skaneateles or Otisco lakes; doubtless, partly because these lakes are so small and partly because there is little tributary country and no convergence of valleys. Of the lake head towns only two,—Watkins and Hammondsport (Fig. 4), are exactly on the lake. Ithaca is nearly at the lake head and is connected with it by a navigable inlet, but the town is separated from the lake by a mile of delta swamp. Similar swamps separate Moravia and Naples from the lakes, and they are situated at the points nearest to the lake where there is a good town site and at the entrance of lateral routes. Moravia is at the mouth of a valley from the east (Figs. 1 and 3), and Naples at a point where valleys converge from the south, east, and west.

All of these lake-head towns are located on routes of travel of secondary importance—cross routes—and in a hilly plateau country of only moderate resources. Even where other routes converge upon them, they are minor in importance to the cross route itself, so that there is little contribution of resources either from the surrounding country or from abroad. Consequently, it could not be expected that any of these places should attain large size or great importance as industrial centers. They are, in the main, little more than distributing centers for a small area of country of no great productiveness. Geographic laws are inflexibly opposed to their growth beyond certain moderate limits. The operation of the same laws that have led to the growth of New York and Buffalo, to the smaller cities of Syracuse and Rochester, and the still smaller centers of Binghamton and Elmira, have determined for these lake-head towns and others on the cross routes of central New York an even more subordinate rank.

Lake Outlet Towns. The lower ends of the lakes have, on the whole, proved more favorable sites for towns than the upper ends (Fig. 1). There are some apparent contradictions to this statement; but the total of the lake outlet town population is far in excess of the total of the lake-head towns. There are several reasons for this. In the first place the lake outlet towns are distributing centers for products brought from all along the lakes and they thus

FIG. 5—Photograph of the U. S. Geological Survey topographic map to show the location of Ithaca, and the railway lines leading to it. C. U. is site of Cornell University.

have a large contributing area; secondly, they are nearer the great northern highway toward which products tend; thirdly, they are in a more open and much more fertile country than the lake-head towns which are situated in the bottoms of valleys deeply sunk in the hilly plateau; and finally, a number of the lake outlet towns have water power regulated by a large lake.

Most of the lake outlet towns are exactly on the lake or on navigable outlets close by the lake. Canandaigua is practically at the outlet of Canandaigua Lake, as is Penn Yan on Keuka Lake and Skaneateles on Skaneateles Lake. Auburn is about three miles from Owasco Lake, making use of water power from the outlet stream. The absence of a large town at the outlet of Cayuga Lake is notable, for the town of Cayuga is the smallest of all the lake outlet towns, while Ithaca at the head of Cayuga Lake is the largest of all the lake-head towns. The absence of a large town at the lower end of Cayuga Lake is due to several facts, as follows:—(1) the presnce of a very extensive area of swamp there; (2) the near presence of large towns serving the needs of the surrounding region; and (3) the development of Seneca Falls, three miles west of the head of Cayuga Lake, on the site of a fall in the outlet of Seneca Lake.

The lake outlet towns fall into a fairly straight line, and this fact (Fig. 1), together with the cause for it, has had not a little influence on their growth. From Syracuse westward the great northern highway extends as an open and easily traversed route; but from Syracuse southwestward there are two barriers to free travel: (1) the hilly plateau, (2) the long Finger Lakes. Routes to the southwest therefore, follow the northern edge of the plateau and swing around the lake heads. This makes the lake-head towns the crossing points of north-south cross routes and an east-west route diverging from the northern highway. The towns along this diverging route—Marcellus, Skaneateles, Auburn, Owego, Seneca Falls, Waterloo, Geneva and Canandaigua—exceed in population the combined population of the towns on the northern highway between Syracuse and Rochester. The growth of these lake-head towns so near the northern highway has doubtless had the effect of diminishing the growth and prosperity of the towns along the Erie Canal between Syracuse and Rochester.

The Lake Shores. The shores of the lakes are remarkably barren of towns (Figs. 1, 4, and 7). Throughout most of their extent there are none. One reason for this is the absence of sites, for the valley sides descend steeply to the lake, often terminating in

Fig. 6—Photograph of the U. S. Geological Survey topographic map to show the location of Watkins (W), Montour Falls (M. F.), Burdett (B), and Odessa (O).

a shale cliff faced by a narrow gravel beach. A second reason is the fact that, in general, the side valleys converging upon the main lake valley are short and, therefore, serving only a small tributary country. Moreover, these lateral valleys usually terminate as hanging valleys several hundred feet above the lake level, being extended to the lake by narrow, steep-walled gorges, occupied by a succession of cascades and waterfalls.

Here and there the streams have built deltas out into the lakes, and these are in many cases seized upon as the sites of hotels and summer cottages, or even, in some cases, as a small village center. In one or two places, as at the mouth of Salmon Creek on the east side of Cayuga Lake, the deltas have been utilized as the sites of salt plants; and at one or two places, as at Dresden on the west side of Seneca Lake, the entrance of a valley—the outlet of Keuka Lake—which can be traversed by roads and which opens up a fairly large tributary country, has led to the development of a town of some importance. Toward the north, where the lake valley walls become less steep, so that town sites on the lake shore are possible, there is more settlement and there are even some villages. This condition finds its best illustration on the east side of Cayuga Lake, where Aurora, Levanna and Union Springs are located.

In general, though, the lake shores are free from centers of population between the lake head and lake outlet. Towns and villages are much fewer and smaller along these parts of the cross routes than along any other portions of either these particular cross routes, or of others in the plateau region of central New York. Indeed, except at the lake heads and lake outlets, there is not a single large town or city in the hundreds of miles of lake shore line. A single geographic factor, water transportation, invites centers of population, and one might at first be surprised at their absence; but other geographic influences either oppose or prohibit such centers.

Gorge Head Towns. The absence of centers of population along the lake shores is related to another phenomenon. The lake shores themselves are not natural highways, for along most of the lake shores there are only narrow gravel beaches backed either by a wave cut cliff or by a steeply rising hillside. The hillslope above the wave cut cliff is also unfavorable for a highway, because of the fact that the steepened valley slope is gashed by numerous gorges cut in the shale by the streams descending the steepened slope from the hanging and other upland valleys (Figs. 4, 6 and 7). There are scores of such gorges on either side of Cayuga and Seneca Lakes; and in the other of the Finger Lake valleys similar conditions exist, though in much less pronounced manner.

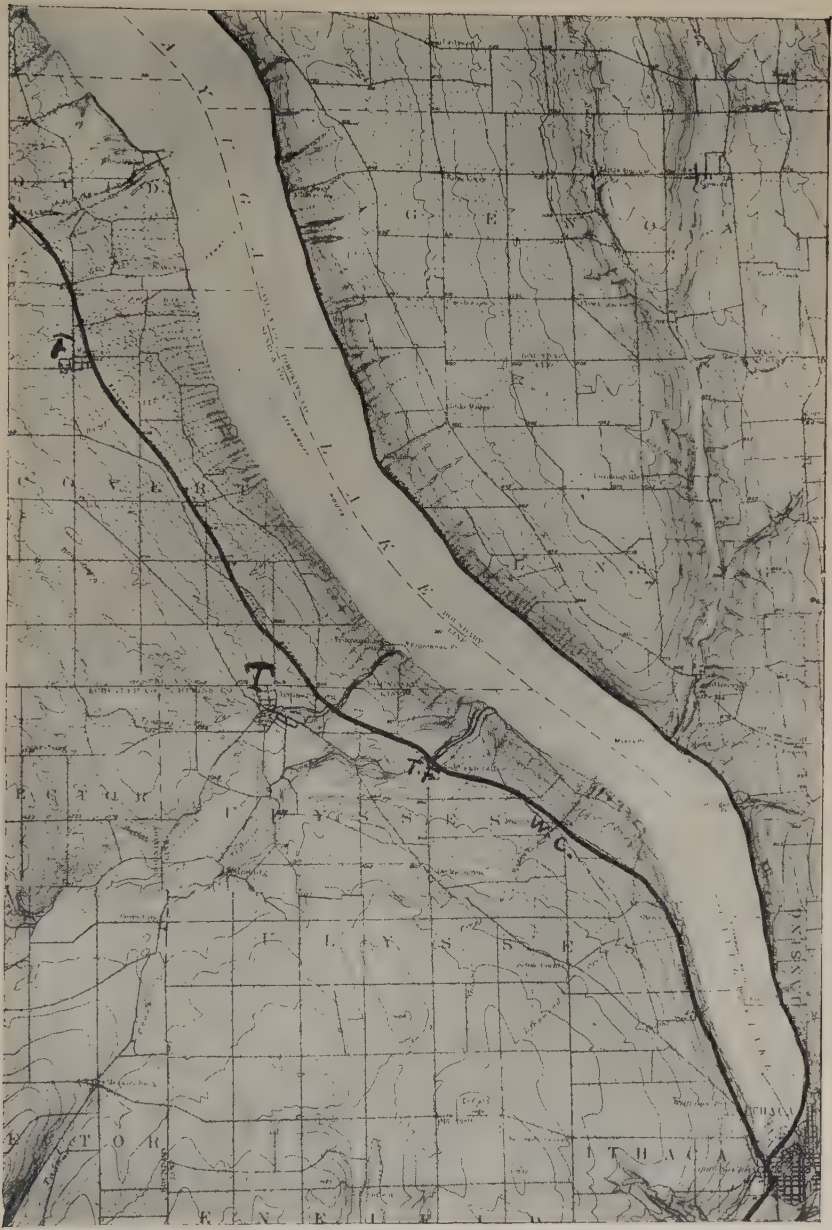

FIG. 7—Photograph of the U. S. Geological Survey topographical map showing the steepened lower slopes of the Cayuga valley, the gorges and the gorge head towns. O, Ovid Center; F, Farmer; T, Trumansburg; T F, Taghanic Falls; W C, Willow Creek.

For free travel north and south along the shores of these lakes, especially the two larger, it is necessary to go back some distance from the lake, above the edge of the steepened slope, in order to pass around the gorge heads and thus avoid the necessity of expensive bridges. Roads have been more influenced by this condition than railroads, though they, too, show evidence of its influence. The influence of the steepened slope and the associated gorges is best illustrated on the west side of Cayuga Lake, where both the roads and the railway are deflected by the topographic conditions. The roads were first deflected and centers of population have developed at points along them where other geographic conditions favored, as for instance, the entrance of a side valley, or the presence of water power, or the convergence of roads. Thus, at a distance of from one to three miles back from the lake one finds a succession of villages either at gorge heads or along the highway which extends above the gorge heads (Fig. 7). Here are found Newfield, Enfield Falls, Willow Creek, Taghanic Falls, Trumansburg, Covert, Farmer, Ovid Center and other villages, while to the eastward as far as the lake shore, and westward to the gorge head towns of Seneca valley there are no centers of population of equal size.

The east side of Cayuga Lake and both sides of Seneca Lake illustrate the same geographic influence (Fig. 4), but it is not necessary to specify the villages involved, for a glance at a topographic map will show the chain of villages whose location has been thus determined. That the roads are more under this influence than the railroads finds clear proof on the east side of Seneca Lake (Fig. 6), for here the gorge head towns of Burdett and Hector are below the railway, while Lodi and Ovid are above the railway; but all are on the main wagon road.

Effect of Convergence of Routes. In this region, as elsewhere, the question of highways is fundamental in influencing the location and growth of centers of population. While there are cases where towns have grown up on a single highway, by far the greatest number are situated at points where two or more routes converge. This has been illustrated again and again by the towns described above,—for example, Binghamton (Fig. 2), Sayre, Elmira (Fig. 1), Ithaca (Fig. 5), Cortland (Fig. 3), Rochester, and, in fact, almost all the others mentioned in the preceding pages.

Besides these illustrations of the influence of convergent routes, one can find scores of illustrations among the smaller villages and even among the crossroad hamlets. Mecklenburg, Lisle, Spencer, Van Etten and a multitude of other places illustrate this influence

among the smaller towns, some of them on the cross routes, some away from them, but almost all in valleys. The influence of convergent routes is much more noticeable in this hilly country than it would be in a more level region; and it becomes more and more noticeable in the more hilly parts of the plateau, for here the topography has increasing influence in directing the roads. The effect of the convergence on the size and growth of the towns has evidently been proportional to:—(1) the number of converging routes, (2) the extent of contributing country thus centered at the point of convergence, and (3) the facilities of transportation over the various routes. With the convergence of more than two highways, connecting with a wide area of country, and offering railroad transportation, good-sized towns and cities have developed, as at Binghamton and Cortland; but with convergence of wagon roads alone, and the bringing of a limited area tributary to the point of convergence, only small villages like Richford and Mecklenburg have been possible.

The influence of convergence of routes may be traced down to the very smallest centers, and even in the more remote parts of the upland. For example, the village of Virgil, at an elevation of 1,420 feet, is located at a point where roads following upland valleys converge, and it may be taken as a type of scores of similar upland villages and hamlets. While these are usually in the valleys, there are some cases where the hamlets are on the upland itself, as at North Barton at an elevation of 1,580 feet. In such locations, however, the centers are merely four-corners, with a half dozen or a dozen houses, a church and a school-house. This is, however, an illustration of the influence of convergence of routes, just as certainly as in the cities mentioned; but the routes open up a limited area of sparsely settled contributing country of little productivity, and the facilities of transportation are of the poorest—hilly roads, snow-covered in winter and deep in mud during spring and fall.

Many and probably most of the points where there is a distinct convergence of easily travelled routes received their first impulse of growth in the early days of stage-coach travel. Some of these points have increased greatly in size and importance under the influence of the railroad; but others, now side-tracked, have either shown no marked growth or have actually declined. Stage routes did not necessarily follow the graded valleys which the railroads now occupy; and since their object was the carrying of passengers and small packages rather than freight, they often sought different directions. For example, one of the principal stage routes in central New York

was the Catskill turnpike, running up hill and down in a general southeast direction. It crossed the through valleys here and there, as at Lisle, Richford and Ithaca, but it did not follow them as the railroads do. In the days of the stage-coach this was a busy thoroughfare,—for the time; but now the arteries of trade cross it at right angles, and it has little more importance than the other roads between small settlements. Signs of the former importance of this highway are evident every here and there; but nowhere more clearly than at Sullivanville, a few miles north of Elmira. This is a veritable deserted village, with its fine large hostelries all closed and in a sad state of decay.

Influence of Mineral Resources. The central New York plateau is not rich in mineral resources and, therefore, there is little direct influence of mineral wealth; but all the region is greatly influenced by the neighborhood of coal in Pennsylvania and by the facilities for transportation of other mineral substances from outside.

Syracuse is the best instance of the direct effect of mineral deposits on the growth of the towns of this section. Salt springs led to its location; a thriving salt manufacturing industry followed, and some is still carried on; and the introduction of salt water from the south has given the basis for the industry of soda-making at Solway, a suburb of Syracuse. Salt is also obtained at several other points from the extensive bed that underlies the plateau of central New York; for instance, there are two salt-making plants at Ithaca and another a few miles farther north, while there are also several in the Seneca valley at and near Watkins. These works have had only minor influence in the growth of the towns.

There are clay workings at a few points, giving support to small centers of population, as at Nina, south of Ithaca; stone quarries, as at Farley's, on the east shore of Cayuga Lake; gypsum quarries at several points, and cement works at Portland, north of Ithaca. To these mineral industries, dealing with heavy imperishable commodities, the facilties of water transportation along the Finger Lakes and the Erie Canal have been of the greatest importance; but neither of the industries has of itself led to the growth of large centers of population.

There are some spring waters of repute which have led to or aided in the growth of several small centers, as at Slaterville Springs, Watkins and Clifton Springs, the former a summer resort of some note, the two latter the seats of well-known Sanitaria. On the whole, therefore, the influence of mineral resources on the location

and growth of towns in central New York has been of only very slight importance.

The Influence of Water Power. The finest power in this part of the State is at the falls of the Genesee at Rochester, and this power has been of basal importance in the location and growth of Rochester. Some of the lake outlets also furnish power, though others are sluggish. This is true, for instance, of the largest outlet of all, Seneca River, which carries the combined waters of Cayuga and Seneca Rivers in sluggish course over an extensive area of swamp land. This is most unfortunate, since there is here a large body of water regulated in the huge reservoirs of the two largest of the Finger Lakes.

Skaneateles outlet furnishes power to villages along its course, as at Skaneateles Falls; Owasco outlet furnishes power to Auburn; Seneca outlet to Seneca Falls (Fig. 1); and other power of minor importance is supplied at other points by the lake outlet streams. Further west the Portage Falls of the Genesee are valuable for their water power.

Along the steepened slopes of the north-south valleys there are a multitude of waterfalls, especially in the southern half of the Seneca and Cayuga valleys. Some of these had early influence in the location and growth of towns, as at Montour Falls and Ithaca; but their present influence is of little value. All the streams are short, and their volume is variable, having been rendered even more so by the stripping off of the forest from the upland. Even the largest of these streams often run nearly dry in summer; and in winter their volume shrinks by freezing. They are, therefore, most unreliable as sources of power, even with the aid of such small reservoirs as have been built to store the waters for use in times of drought.

At certain seasons, and often for weeks at a time, there is an enormous amount of water power going to waste in the gorges that gash these ice-steepened valley walls. If the storage battery ever becomes perfected, there is here an asset of great value; and, even without it, there are opportunities for the development of large quantities of regulated power by the building of extensive storage reservoirs. That this will ever be done in a region of such limited resources can hardly be predicted with safety. Possibly, for all time the hundreds of streams with fluctuating water power will be allowed to run to waste as now.

Details of Location. Besides the general geographic factors determining the location of towns and cities in the central New

York region, there are minor geographic influences that have led to the determination of the exact sites of towns. For example, where one or more hanging valleys open out at the upper limit of the steepened slope of the main valley there are often small plateaus well above the main valley bottom, and separated from it by a steep valley side on which a town site would not normally develop. This condition is best illustrated by the site of Cornell University, which occupies such a hanging valley plateau over 400 feet above the main valley bottom (Fig. 5). There is here a fairly level site and here are situated the University buildings, together with a large number of residences, making a small town. Below, in the valley bottom is Ithaca, with four hundred feet of steep hillside between. Naturally, under the peculiar conditions existing here, with an important institution above, and the business center below, the adverse geographic conditions of a steep hillside have been in part ignored; streets are run up the steep slope and house lots have been established by grading. Thus the University site and town site are connected by a continuous series of hillside houses along a portion of the steepened valley slope. It is the only case in the plateau of central New York where a section of the steepened valley side has been chosen as the home site for a large number of people.

Elsewhere in the Cayuga and Seneca valleys there are instances of villages built at the outer edge of the hanging valleys, and these are, naturally, also gorge-head towns. Of these Trumansburg in the Cayuga valley (Fig. 7), and Odessa, Burdett (Fig. 6), and Dundee in the Seneca valley may be taken as illustrations.

Another type of village site on the valley slopes is that furnished by the hanging deltas that were built in the lake waters when a glacier dam across the northern part of the Cayuga and Seneca valleys caused the lake waters to rise high above their present level. These sites are often used for the location of single houses or small groups of houses, as at Ithaca near the University campus; and in at least one case, North Hector in the Seneca valley, one of these deltas is the site of a small village. A part of Trumansburg is also built on such a hanging delta.

Alluvial fans are favorite sites for valley towns and villages. This is due to three causes:—(1) the fact that the valley bottoms are often level and damp; (2) the fact that the alluvial fans are built up at the points where lateral streams enter the main valley, and are therefore at the convergence of highways; and (3) the fact that the alluvial fans are slightly elevated, are built of gravel through which water easily percolates, and have slopes down which

the surface water easily runs,—all factors aiding in making dry sites for houses.

Scores of instances of towns and villages on alluvial fans are found in the plateau region. In some cases the influence of the fan in determining the town site is very noticeable. For example, Watkins and Ithaca are both located on a swampy delta at the lake head, and in general, without artificial drainage or extensive filling, these deltas are uninhabitable near the lakes. The alluvial fans of Six Mile, Cascadilla and Fall Creeks have built up a part of the delta on the east side of the Cayuga valley near the lake head, so that a portion of the delta surface is no longer swampy; and Glen Creek at Watkins has made a similar alluvial fan on the west side of Seneca Lake head. These dry sites have become town sites in the midst of swamp land.

Outwash gravel plains built during the recession of the continental glacier, being well drained, have served as excellent town sites in many of the valleys. Horseheads, Elmira, Spencer, Candor, and Owego are illustrations of this class of town site.

SUMMARY. Summarizing briefly the underlying principles which have determined the location and growth of the towns and cities of central New York, it is clear, in the first place, that the question of highways is the point of primary and basal importance. The principal towns are on the leading highway in the north; and the towns next in size are on the secondary highway in the south. The other towns of the region are on byways and cross routes between the two main highways. The small size and limited growth of the latter are due mainly to the following geographical conditions:—(1) they are on byways; (2) they are in the midst of a rugged, dissected plateau, offering obstacles to easy travel by rail or road, except along a limited number of routes; (3) the plateau, a region of hilly upland with prevailingly thin, stony, infertile soil, is a region of limited agricultural resources with a diminishing population; (4) there is little water power; and (5) there is a general lack of important mineral resources.

The invasion by the continental glacier has unfavorably influenced the region: (1) by making many steep slopes where the valley sides were moderately sloping before the Glacial Period; (2) by sweeping off the soil of residual decay and leaving glacial soil in its place—though in places this was, doubtless, an advantage rather than a disadvantage; (3) by interfering with drainage, flooding some lands, giving rise to gorges, and altering stream directions. On the other hand, the glacial invasion has been a benefit to the

region in some directions, notably in giving rise to water power in some places, in bringing about conditions which have made lake navigation possible, and finally, by causing the through valleys. This latter work of the glacier is of great significance, and probably counterbalances all the disadvantages. The through valleys have guided the course of railways, some of them trunk lines, along the cross valleys; and where the through valleys converge, towns and cities have naturally grown.

Altogether, the central New York plateau region illustrates perfectly the relation between man and his environment. Geographic conditions unfavorable to many forms of agriculture have led to a change in the industry and a decline in the farming population; they have been adverse to mining and manufacturing; and they have been unfavorable to the growth of large centers of population. The location of these centers, as well as their growth, has been guided by geographic conditions, and the influence of those conditions may be traced in various directions, even in minute detail; but, in the main, the growth of towns and cities has been dependent primarily upon the routes of travel, which are dependent directly upon the topography.

GEOGRAPHY AND SOME OF ITS PRESENT NEEDS*

Geographical Progress in the Last Decade

Among the many geographical results of work in the past decade a few may be mentioned. The measurement of new and the remeasurement of old arcs will give us better data for determining the size and shape of the Earth. Surveys of all kinds, from the simple route sketches of the traveler to the elaborate cadastral surveys of some of the more populous and settled regions have so extended our knowledge of the surface features of the Earth that a map on the scale of 1:1,000,000 is not merely planned, but actually partly executed. Such surveys and such maps are the indispensable basis of our science.

The progress of oceanography has also been great. The sound-

*This article presents most of the opening address of A. J. Herbertson, M.A., Ph.D., Professor of Geography at the University of Oxford, delivered as President of Section E, Geography, at the recent meeting of the British Association for the Advancement of Science. The paper is printed in full in *Nature*, Sept. 22, 1910.

ings of our own and other Admiralties, of scientific oceanographical expeditions, and those made for the purpose of laying cables, have given us much more detailed knowledge of the irregularities of the ocean floor. An international map of oceanic contours, due to the inspiration and munificence of the Prince of Oceanographers and of Monaco, has been issued during the decade, and so much new material has accumulated that it is now being revised. A comparison of the old and new editions of Krümmel's "Ozeanographie" shows us the immense advances in this subject.

Great progress has been made on the geographical side of meteorology and climate. The importance of this knowledge for tropical agriculture and hygiene has led to an increase of meteorological stations all over the hot belt—the results of which will be of value to the geographer. Mr. Bartholomew's "Atlas of Meteorology" appeared at the beginning, and Sir John Eliot's "Meteorological Atlas of India" at the end, of the decade. Dr. Hann's "Lehrbuch" and the new edition of his "Climatology," Messrs. Hildebrandsson and Teisserenc de Bort's great work, and the recent studies of the Upper Atmosphere, are among the landmarks of progress. The record is marred only by the closing of Ben Nevis Observatory at the moment when its work would have been most necessary. To appreciate the progress of climatology it is only necessary to compare the present number and distribution of meteorological stations with those given in Bartholomew's Atlas of 1899. I have not time to recapitulate the innumerable studies of geographical value issued by many meteorological services, observatories, and observers—public and private—but I may direct attention to the improved weather maps and to the excellent pilot charts of the North Atlantic and of the Indian Ocean published monthly by our Meteorological Office.

Lake studies have also been a feature of this decade, and none is so complete or so valuable as the Scottish Lakes Survey—a work of national importance, undertaken by private enthusiasm and generosity. We have to congratulate Sir John Murray and Mr. Pullar on the completion of a great work.

In Geology, I might note that we now possess a map of Europe on a scale of 1:1,500,000 prepared by international cooperation, and also one of North America on a smaller scale; both invaluable to the geographer. The thanks and congratulations of all geographers are due to Prof. Suess on the conclusion of his classical work on the Face of the Earth, the first comprehensive study of the main divisions and characteristics of its skeleton.

A new movement, inspired mainly by Prof. Flahault in France,

Prof. Geddes in this country, Profs. Engler, Drude, and Schimper in Germany, has arisen among botanists, and at last we have some modern botanical geography which is really valuable to the geographer. I wish we could report similar progress in zoological geography, but that, I trust, will come in the next decade.

The Need for Classification and Notation in Geomorphology, etc.

I should like to say a few words about the subdivisions of geography and the vexed question of terminology.

In the scheme of the Universe it is possible to consider the Earth as a unit, with its own constitution and history. It has an individuality of its own, though for the astronomer it is only one example of a particular type of heavenly bodies. As geographers, we take it as our unit individual in the same way that an anatomist takes a man. We see that it is composed of different parts, and we try to discover what these are, of what they are composed, what their function is, what has been their history.

One fundamental division is into land, water, and air. Each has its forms and its movements. The forms are more obvious and persistent in the land. They are least so in the atmosphere, though forms exist—some of which are at times made visible by clouds, and many can be clearly discerned on isobaric charts. The land is the temporarily permanent; the water and atmosphere the persistently mobile, the latter more so than the former. The stable forms of the land help to control the distribution and movements of the waters, and to a less extent those of the atmosphere. How great the influence of the distribution of land and water is on the atmosphere may be seen in the monsoon region of eastern Asia.

The study of the land, the ocean, and the atmosphere has resulted in the growth of special branches of knowledge—Geomorphology, Oceanography, and Climatology. Each is indispensable to the geographer, each forms an essential part of the geographical whole. Much research work is and will be carried on in each by geographers who find their geographical studies hampered for the lack of it. As geographical progress is to a considerable extent conditioned by progress in these subjects, it would be legitimate to examine their needs. Time, however, will admit only a note on one of the barriers to progress in geomorphology—the lack of a good classification and notation.

Geomorphology deals with the forms of the land and their shaping. Three things have to be kept clearly in view: (1) The struc-

ture, including the composition, of the more permanent substance of the form; (2) the forces which are modifying it; and (3) the phase in the cycle of forms characteristic of such structure acted on by such forces. We may say that any form is a function of structure, process, and time. The matter is even more complicated, for we have instances, *e. g.*, in antecedent drainage systems, of the conditions of a previous cycle affecting a subsequent one—a kind of heredity of forms which cannot be neglected.

The geomorphologist is seeking for a genetic classification of forms and in the works of Bertrand, Davis, de la Noë and de Margerie, Penck, Richthofen, Suess, and Supan and their pupils are being accumulated the materials for a more complete and systematic classification of forms. As you all know, the question of terms for the manifold land-forms is a difficult one, and apt to engender much more controversy than the analysis of the forms themselves. I believe that we shall find it advantageous to adopt some notation analogous to that of the chemists. I have not yet had time to work such a notation out in detail, but it might take the form of using different symbols for the three factors noted above—say, letters for different kinds of structure, Arabic figures for processes and Roman figures for the stage of a cycle the form has reached.

Take a very simple set of structures and indicate each by a letter:

			UNDISTURBED	FAULTED
Structure	homogeneous		A	A′
	layered	horizontal	B	B′
		tilted	C	C′
		folded	D	D′
	mixed		E	E′

If pervious or impervious, a *p* or an *i* could be added—*e. g.* a tilted limestone with faults would be C′*p*.

Next, indicate the commoner erosion processes by Arabic numerals:

Process	moving water	1
	ice	2
	wind	3
	sea	4

One process may have followed another, *e. g.* where a long period of ice erosion has been followed by water erosion we might write 2.1, where these alternate annually, say 21.

The phase of the cycle might be denoted by Roman figures. A scale of V might be adopted, and I, III, and V used for youthful,

middle-aged, and old-aged, as this has been called, or early, middle, and late phases, as I prefer to term them. II and IV would denote intermediate phases.

A scarped limestone ridge in a relatively mature phase like the Cotswolds would be, if we put the process first, I C1 III.; a highland like the Southern Uplands of Scotland would be denoted by the formula 1.2.1 E1 III.

This is the roughest suggestion, but it shows how we could label our cases of notes and pigeon-hole our types of forms—and prevent for the present undue quarrelling over terms.* No doubt there would be many discussions, for example, about the exact phase of the cycle, whether ice, in addition to water, has been an agent in shaping this or that form, and so on. But, after all, these discussions would be more profitable than quarrels as to which descriptive term, or place-name, or local usage should be adopted to distinguish it.

The use of such notations in geographical problems is not unknown. They were employed by Köppen in his classification of climate; and now, in the case of climatology, there is coming to be a general consensus of opinion as to what are the chief natural divisions, and the use of figures and letters to indicate them has been followed by several other authors. This should also be attempted for oceanography.

If any international agreement of symbols and colors could be come to for such things it would be a great gain, and I hope to bring this matter before the next International Geographical Congress.

The Need for Selecting Natural Geographical Units

We have still to come to Geography proper, which considers land, water, and air, not merely separately but as associated together. What are the units smaller than the whole Earth with which our science has to deal?

When we fix our attention on parts of the Earth and ask what is a natural unit, we are hampered by preconceptions. We recognize species, or genera, families, or races as units—but they are abstract rather than concrete units. The reason for considering them as units is that they represent a historical continuity. They have not an actual physical continuity such as the component parts of an individual have. Concrete physical continuity in the present is what

* What I wish to make clear is that it is not necessary to invent a new term for every new variety of land form as soon as it is recognized. It will suffice at first to be able to label it. The notation will also stimulate the search for and recognition of new varieties.

differentiates the geographical unit. Speaking for myself, I should say that every visible concrete natural unit on the Earth's surface consisting of more than one organic individual is a geographical unit. It is a common difficulty not to be able to see the wood for the trees; it is still more difficult to recognize that the wood consists of more than trees, that it is a complex of trees and other vegetation, fixed to a definite part of the solid earth and bathed in air. We may speak of a town or State as composed of people, but a complete conception of either must include the spacial connections which unite its parts. A town is not merely an association of individuals, nor is it simply a piece of land covered with streets and buildings; it is a combination of both.

It is true that in determining the greater geographical units, man need not be taken into account. We are too much influenced by the mobility of man, by his power to pass from one region to another, and we are apt to forget that his influence on his environment is negligible except when we are dealing with relatively small units. The geographer will not neglect man; he will merely be careful to prevent himself from being unduly influenced by the human factor in selecting his major units.

Some geographers and many geologists have suggested that land forms alone need be taken into account in determining these larger geographical units. Every different recognizable land form is undoubtedly a geographical unit. A vast lowland, such as that which lies to the east of the Rocky Mountains, is undoubtedly a geographical unit of great importance, but its geographical subdivisions are not necessarily orographical. The shores of the Gulf of Mexico could not be considered as geographically similar to those of the Arctic Ocean, even if they were morphologically homologous. The lowlands of the polar regions are very different from those at or near the tropics. The rhythm of their life is different, and this difference is revealed in the differences of vegetation.

I wish to lay great stress on the significance of vegetation to the geographer for the purposes of regional classification. I do not wish to employ a biological terminology nor to raise false analogies between the individual organism and the larger units of which it is a part, but I think we should do well to consider what may be called the life or movement going on in our units as well as their form. We must consider the seasonal changes of its atmospheric and of its water movements, as well as the parts of the Earth's crust which they move over and even slightly modify. For this purpose a study of climatic regions is as necessary as a study of morphological

regions, and the best guides to the climatic regions are the vegetation ones.

By vegetation I mean not the flora, the historically related elements, but the vegetable coating, the space-related elements. Vegetation in this sense is a geographical phenomenon of fundamental importance. It indicates quality—quality of atmosphere and quality of soil. It is a visible synthesis of the climatic and edaphic elements. Hence the vast lowlands of relatively uniform land features are properly divided into regions according to vegetation—tundra, pine forest, deciduous forest, warm evergreen forest, steppe, and scrub. Such differences of vegetation are full of significance even in mountainous areas.

The search after geographical unity—after general features common to recognizable divisions of the Earth's surface, the analysis of these, their classification into types, the comparisons between different examples of the types—seem to me among the first duties of a geographer. Two sets of studies and maps are essential—topographical and vegetational—the first dealing with the superficial topography and its surface irregularities, the latter relating to the quality of climate and soil.

Much has been said in recent years—more particularly from this Presidential chair—on the need for trustworthy topographical maps. Without such maps no others can be made. But when they are being made it would be very easy to have a general vegetational map compiled. Such maps are even more fundamental than geological maps, and they can be constructed more rapidly and cheaply. Every settled country, and more particularly every partially settled country, will find them invaluable if there is to be any intelligent and systematic utilization of the products of the country. Possessing both sets of maps, the geographer can proceed with his task.

This task, I am assuming, is to study environments, to examine the forms and qualities of the Earth's surface, and to recognize, define, and classify the different kinds of natural units into which it can be divided. For these we have not as yet even names. It may seem absurd that there should be this want of terms in a subject which is associated in the minds of most people with a superfluity of names. I have elsewhere suggested the use of the terms major natural region, natural region, district, and locality to represent different grades of geographical units, and have also attempted to map the seventy or eighty major natural regions into which the Earth's surface is divided and to classify them into about twenty types. These tentative divisions will necessarily become more ac-

curate as research proceeds, and the minor natural regions into which each major natural region should be divided will be definitely recognized, described, and classified. Before this can be done, however, the study of geomorphology and of plant formations must be carried far beyond the present limits.

The value of systematic and exhaustive studies of environment such as those I suggest can hardly be exaggerated. Without them all attempts to estimate the significance of the environment must be superficial guesswork. No doubt it is possible to exaggerate the importance of the environmental factor, but it is equally possible to undervalue it. The truly scientific plan is to analyze and to evaluate it. Problems of the history of human development, as well as those of the future of human settlements, cannot be solved without this. For the biologist, the historian, the economist, the statesman, this work should be carried out as soon and as thoroughly as is possible in the present state of our knowledge.

A beginning of systematic geographical studies has also been made at the opposite end of the scale in local geographical monographs. Dr. H. R. Mill, one of the pioneers of geography in this country and one of my most distinguished predecessors in this chair, has given us in his study of south-west Sussex an admirable example of the geographical monograph proper, which takes into account the whole of the geographical factors involved. He has employed quantitative methods so far as these could be applied, and in doing so has made a great step in advance. Quantitative determinations are at least as essential in geographical research as the consideration of the time factor. At Oxford we are continuing Dr. Mill's work. We require our diploma students to select some district shown on a sheet of this map for detailed study by means of map measurements, an examination of statistics and literature which throw light on the geographical conditions, and, above all, by field work in the selected district. Every year we are accumulating more of these district monographs, which ought, in their turn, to be used for compiling regional monographs dealing with the larger natural areas. In recent years excellent examples of such regional monographs have come from France and from Germany.

The geomorphologist and the sociologist have also busied themselves with particular aspects of selected localities. Prof. W. M. Davis, of Harvard, has published geomorphological monographs which are invaluable as models of what such work should be. In a number of cases he has passed beyond mere morphology and has directed attention to the organic responses associated with each land

form. Some of the monographs published under the supervision of the late Prof. Ratzel, of Leipzig, bring out very clearly the relation between organic and inorganic distributions, and some of the monographs of the Le Play school incidentally do the same.

The Double Character of Geographical Research

To carry on geographical research, whether on the larger or the smaller units, there is at present a double need—in the first place, of collecting new information, and, in the second place, of working up the material which is continually being accumulated.

The Need for the Systematic Collection of Data

The first task—that of collecting new information—is no small one. In many cases it must be undertaken on a scale that can be financed only by Governments. The Ordnance and Geological Surveys of our own and other countries are examples of Government departments carrying on this work. We need more of them. The presidents of the Botanical and Anthropological Sections are, I understand, directing the attention of the Association to the urgent necessity for complete Botanical and Anthropological Surveys of the kingdom. All geographers will warmly support their appeal, for the material which would be collected through such surveys is essential to our geographical investigations.

Another urgent need is a Hydrographical Department, which would cooperate with Dr. Mill's rainfall organization. It would be one of the tasks of this department to extend and coordinate the observations on river and lake discharge, which are so important from an economic or health point of view that various public bodies have had to make such investigations for the drainage areas which they control. Such research work as that done by Dr. Strahan for the Exe and Medway would be of the greatest value to such a department. We shall see how serious the absence of such a department is if we consider how our water supply is limited, and how much of it is not used to the best advantage. We must know its average quantity and the extreme variations of supply. We must also know what water is already assigned to the uses of persons and corporations, and what water is still available. We shall have to differentiate between water for the personal use of man and animals, and water for industrial purposes. The actualities and the potentialities can be ascertained, and should be recorded and mapped.

The Need for the Application of Geographical Methods to already Collected Data

In the second direction of research—that of treating from the geographical standpoint the data accumulated, whether by Government departments or by private initiative—work has as yet hardly been begun.

The topographical work of the Ordnance Survey is the basis of all geographical work in our country. The Survey has issued many excellent maps, none more so than the recently published half-inch contoured and hill-shaded maps with colors "in layers." Its maps are not all above criticism; for instance, few can be obtained for the whole kingdom having precisely the same symbols. It has not undertaken some of the work that should have been done by a national cartographic service—for instance, the lake survey. Nor has it yet done what the Geological Survey has done—published descriptive accounts of the facts represented on each sheet of the map. From every point of view these are great defects; but in making these criticisms we must not forget (1) that the Treasury is not always willing to find the necessary money, and (2) that the Ordnance Survey was primarily made for military purposes, and that the latest map it has issued has been prepared for military reasons. It has been carried out by men who were soldiers first and topographers after, and did not necessarily possess geographical interests.

The ideal geographical map, with its accompanying geographical memoir, can be produced only by those who have had a geographical training. Dr. Mill, in the monograph already referred to, has shown us how to prepare systematized descriptions of the one-inch map sheets issued by the Ordnance Survey.

The preparation of such monographs would seem to fall within the province of the Ordnance Survey. If this is impossible, the American plan might be adopted. There the Geological Survey, which is also a topographical one, is glad to obtain the services of professors and lecturers who are willing to undertake work in the field during vacations. It should not be difficult to arrange similar cooperation between the universities and the Ordnance Survey in this country. At present the Schools of Geography at Oxford and at the London School of Economics are the only university departments which have paid attention to the preparation of such monographs, but other universities will probably fall into line. Both the universities and the Ordnance Survey would gain by such coopera-

tion. The chief obstacle is the expense of publication. This might reasonably be made a charge on the Ordnance Survey, on condition that each monograph published were approved by a small committee on which both the universities and the Ordnance Survey were represented.

The Geological Survey has in recent years issued better and cheaper one-inch maps, and more attention has been given to morphological conditions in the accompanying monographs; but it is necessary to protest against the very high prices which are now being asked for the older hand-colored maps. The new quarter-inch map is a great improvement on the old one, but we want "drift" as well as "solid" editions of all the sheets. The geographer wants even more than these a map showing the quality of the solid rock, and not merely its age. He has long been asking for a map which would indicate the distribution of clay, limestone, sandstone, &c., and when it is prepared on the quarter-inch, or better on the half-inch, scale the study of geomorphology and of geography will receive a very great stimulus and assistance.

The information which many other Government departments are accumulating would also become much more valuable if it were discussed geographically. Much excellent geographical work is done by the Admiralty and the War Office. The Meteorological Office collects statistics of the weather conditions from a limited number of stations; but its work is supplemented by private societies which are not well enough off to discuss the observations they publish with the detail which these observations deserve. The Board of Agriculture and Fisheries has detailed statistical information as to crops and live stock for the geographer to work up. From the Board of Trade he would obtain industrial and commercial data and from the Local Government Board vital and other demographic statistics. At present most of the information of these departments is only published in statistical tables.

Statistics are all very well, but they are usually published in a tabular form, which is the least intelligible of all. Statistics should be mapped, and not merely be set out in columns of figures. Many dull Blue-books would be more interesting and more widely used if their facts were properly mapped. I say *properly* mapped, because most examples of so-called statistical maps are merely crude diagrams, and are often actually misleading. It requires a knowledge of geography in addition to an understanding of statistical methods to prepare intelligible statistical maps. If Mr. Bosse's maps of the population of England and Wales in Bartholomew's Survey Atlas

are compared with the ordinary ones, the difference between a geographical map and a cartographic diagram will be easily appreciated.

The coming census, and to a certain extent the census of production, and probably the new land valuation, will give more valuable raw material for geographical treatment. If these are published merely in tabular form they will not be studied by any but a few experts. Give a geographer with a proper staff the task of mapping them in a truly geographical way, and they will be eagerly examined even by the man in the street, who cannot fail to learn from them. The representation of the true state of the country in a clear, graphic, and intelligible form is a patriotic piece of work which the Government should undertake. It would add relatively little to the cost of the census, and it would infinitely increase its value.

The Need of Reorganizing the Geographical Factor in Imperial Problems

With such quantitative information geographically treated and with a fuller analysis of the major natural regions it ought to be possible to go a step further and to attempt to map the economic value of different regions at the present day. Such maps would necessarily be only approximations at first. Out of them might grow other maps prophetic of economic possibilities. Prophecy in the scientific sense is an important outcome of geographical as well as of other scientific research. The test of geographical laws, as of others, is the pragmatic one. Prophecy is commonly but unduly derided. Mendeléeff's periodic law involved prophecies which have been splendidly verified. We no longer sneer at the weather prophet. Efficient action is based on knowledge of cause and consequence, and proves that a true forecast of the various factors has been made. Is it too much to look forward to the time when the geographical prospector, the geographer who can estimate potential geographical values, will be as common as and more trustworthy than the mining prospector?

The day will undoubtedly come when every Government will have its Geographical-Statistical Department dealing with its own and other countries—an Information Bureau for the administration corresponding to the Department of Special Inquiries at the Board of Education. At present there is no geographical staff to deal geographically with economic matters or with administrative matters. Yet the recognition of and proper estimation of the geographical factor is going to be more and more important as the uttermost ends of the Earth are bound together by visible steel lines and steel

vessels or invisible impulses which require no artificial path or vessel as their vehicle.

The development of geographical research along these lines in our own country could give us an Intelligence Department of the kind, which is much needed. If this were also done by other States within the Empire, an Imperial Intelligence Department would gradually develop. Thinking in continents, to borrow an apt phrase of Mr. Mackinder's, might then become part of the necessary equipment of a statesman instead of merely an after-dinner aspiration. The country which first gives this training to its statesmen will have an immeasurable advantage in the struggle for existence.

The Need for the Adequate Endowment of Geography at the Universities

Our universities will naturally be the places where the men, fit to constitute such an Intelligence Department, will be trained. It is encouraging, therefore, to see that they are taking up a new attitude towards geography, and that the Civil Service Commissioners, by making it a subject for the highest Civil Service examinations, are doing much to strengthen the hands of the universities. When the British Association last met in Sheffield geography was the most despised of school subjects, and it was quite unknown in the universities. It owed its first recognition as a subject of university status to the stimulus and generous financial support of the Royal Geographical Society and the brilliant teaching of Mr. Mackinder at Oxford. Ten years ago Schools of Geography were struggling into existence at Oxford and Cambridge, under the auspices of the Royal Geographical Society. A single decade has seen the example of Oxford and Cambridge followed by nearly every university in Great Britain, the University of Sheffield among them. In Dr. Rudmose Brown it has secured a scientifically trained traveler and explorer of exceptionally wide experience, who will doubtless build up a Department of Geography worthy of this great industrial capital. The difficulty, however, in all universities is to find the funds necessary for the endowment, equipment, and working expenses of a Geographical Department of the first rank. Such a department requires expensive instruments and apparatus, and, since the geographer has to take the whole World as his subject, it must spend largely on collecting, storing, and utilizing raw material of the kind I have spoken of. Moreover, a professor of geography should have seen much of the World before he is appointed, and it ought to be an important part of his professional duties to travel frequently and

far. I have never been able to settle to my own satisfaction the maximum income which a department of geography might usefully spend, but I have had considerable experience of working a department the income of which was not very far above the minimum. Until now the Oxford School of Geography has been obliged to content itself with three rooms and to make these suffice, not merely for lecture-rooms and laboratories, but also for housing its large and valuable collection of maps and other materials. This collection is far beyond anything which any other university in this country possesses, but it shrinks into insignificance beside that of a rich and adequately supported Geographical Department like that of the University of Berlin. This fortunate department has an income of about 6,000*l.* a year, and an institute built specially for its requirements at a cost of more than 150,000*l.*, excluding the site. In Oxford we are most grateful to the generosity of Mr. Bailey, of Johannesburg, which will enable the School of Geography to add to its accommodation by renting for five years a private house, in which there will temporarily be room for our students and for our collections, especially those relating to the geography of the Empire. But even then we can never hope to do what we might if we had a building specially designed for geographical teaching and research. Again, Lord Brassey and Mr. Douglas Freshfield, a former President of this Section, have each generously offered 500*l.* towards the endowment of a professorship if other support is forthcoming. All this is matter for congratulation, but I need hardly point out that a professor with only a precarious working income for his department is a person in a far from enviable position. There is at present no permanent working income guaranteed to any Geographical Department in the country, and so long as this is the case the work of all these departments will be hampered and the training of a succession of competent men retarded. I do not think that I can conclude this brief address better than by appealing to those princes of industry who have made this great city of Sheffield what it is to provide for the Geographical Department of the University on a scale which shall make it at once a model and a stimulus to every other university in the country and to all benefactors of universities.

GEOGRAPHICAL RECORD

NORTH AMERICA

NEW YORK AND THE FOUR NEXT LARGEST AMERICAN CITIES IN 1910. According to the 1910 Census the growth of New York exceeds anticipation. The city at the Hudson mouth has now over 5,000,000 inhabitants in the four municipalities, New York, Jersey City, Hoboken and Newark. Furthermore it has gained over 1,500,000 since 1900. The city is still smaller than London, but its growth is over twice as rapid, and it will probably outgrow London in the next decade. A year ago it was pointed out (*Bulletin,* Sept., 1909) that there were in the real, closely settled, contiguous city in 1900, 3,636,000 people, after subtracting 330,000 inhabitants of thinly settled areas within the corporate limits that are not properly "city." The official figures of 1910 for the four political units are New York, 4,766,883; Jersey City, 267,779; Hoboken, 70,324; and Newark, 347,469, a total of 5,452,455. As some of the outer parts of the area have now the 10,000 to the square mile that has been used as the limiting value of "city" density, the sum to be subtracted now from the totals for included suburban dwellers is very likely less than in 1900. If we reduce the total above by that number, 330,000, we may confidently say that the real size of New York (anthropographic city) is over 5,120,000.

Chicago, which in 1900 had 1,500,000 people, with an allowance of 199,000 suburban dwellers, has now, making the same allowance, over 1,986,000 people, say 2,000,000.

Philadelphia with Camden, allowing 230,000 suburbanites then and now, had 1,142,000 in 1900 and now 1,413,000, a million and a half.

Boston and its contiguous neighbors, Cambridge, Somerville, Chelsea and Brookline, had 681,000 ten years ago and this year 826,000, after subtracting 87,000 for suburbs in both years.

St. Louis, which is, like Chicago, including everything citified in its neighborhood, had half a million in 1900 and now has 612,000†. 75,000 was subtracted for suburbs each time.

It was hoped by Director Durand of the Census to map the population densities in the larger cities in very small units, at times a city block. When these figures become available we shall have the best basis ever attained for the study of city population—density. For the present we may say that the five largest anthropographic or really urban cities in the United States in 1910 are:

New York*	5,120,000,	growth	148,000	a year.
Chicago	2,000,000	"	49,000	"
Philadelphia*	1,410,000	"	27,000	"
Boston*	830,000	"	15,000	"
St. Louis	610,000	"	11,000	"

The starred cities include contiguous cities. The rates of increase estimated last year for the same places were in round thousands per year 119, 52, 26, 15,

† A misprint at page 566 of the *Bulletin*, 1909, made the anthropographic population of St. Louis in 1900, 575,000. Another, at page 540, gave Philadelphia officially 1,648,000, which should have been 1,293,697.

10. The last four are pretty much as estimated but New York's increase is twenty-four per cent. greater than was then anticipated. M. J.

FUTURE WHEAT SUPPLY. In a paper on "The Future Wheat Supply of the United States," by M. A. Carleton of the U. S. Dep't. of Agriculture (*Science*, Aug. 5, 1910, pp. 161-171), the author gives data which seen to point to the conclusion that from 75,000,000 to 100,000,000 acres will be added to the farm area of the United States, exclusive of Alaska, from the 386,873,787 acres of government lands "unappropriated and unreserved" in 1908 and by additions from present Indian reservations, "unallotted and unreserved," at the close of the fiscal year, 1908. With the natural expansion of farm area in the older states, which will be greater hereafter than heretofore, it seems reasonable to expect 250,000,000 to 300,000,000 acres of additional farm area within the next thirty years. By 1950, therefore, a conservative estimate would make the total farm area of the country more than 1,300,000,000 acres. The average proportion of farm area used for wheat since 1870 has been 5.2 per cent., and this percentage of the future possible farm area would be over 69,000,000 acres, or 22,000,000 acres more than the acreage of 1909.

But the tendency of the wheat acreage is now to increase in the same farm area and, long before 1950, it should again reach 6 per cent. as it did before the wheat depression in the nineties, both because of wheat growing expansion due to increase in prices and because the farm area will hereafter increase less rapidly. In 1910 the wheat acreage is 50,500,000 acres. In 1950, at the rate of 6 per cent. increase, the wheat acreage should be about 80,000,000 acres. The yield of wheat, per acre, is increasing and within the past 30 years the increase has been fully two bushels per acre. Other considerations are also adduced to show that improvements in varieties of wheat, in methods of farming, etc., may raise the yield by 1950, to twenty bushels to the acre, 80,000,000 acres of wheat thus producing 1,600,000,000 bushels.

Basing his estimate of increase of population upon the ratio of increase since 1880, Mr. Carleton assumes that the census will show 160,000,000 inhabitants in 1950, requiring, at the rate of seven bushels of wheat per capita, 1,120,000,000 bushels, leaving a surplus of 480,000,000 bushels. By a similar line of reasoning, he figures that the world will require by 1950, about 5,500,000,000 bushels of wheat, an increase of 2,000,000,000 bushels over present production. The estimated total increase of production will more than fill this requirement. All of Mr. Carleton's estimates and assumptions are well fortified by data relating to increase of population and increase of wheat production and consumption and his paper is a valuable and suggestive contribution to this vital topic.

MACKENZIE MOUNTAINS. In a recent publication of the Geological Survey of Canada* J. Keele introduces a new name in the nomenclature of the Rocky Mountain System. He wishes to designate by "Mackenzie Mountains" the entire mountainous region forming the water-parting between the upper Yukon and the upper Liard, on one side, and the Mackenzie, on the other, and extending in an arc convex to the northeast from the sources of the Porcupine River in 65½° N. to the bend of the Liard River in 59½° N. The Mackenzie Mountains would, therefore, be coincident with the Ogilvie and Selwyn Ranges as defined by the undersigned in a recent paper.† Keele wishes the comprehensive

* A Reconnaissance across the Mackenzie Mountains on the Pelly, Ross and Gravel Rivers, by J. Keele, 1910. [No. 1097]. p. 13.

† *Bull.* Amer. Geog. Soc., Vol. XLII (1910), pp. 176–177.

term to supersede the two distinct names (which he as well as other members of the Survey staff have used in previous reports) because "it has been found impossible to define the limits of these subdivisions, on topographic grounds." He, however, retains the name Selwyn Mountains (in this form) for that part of the Mackenzie Mountains in which the upper branches of the Macmillan and Ross Rivers head. (*cf.* the map accompanying the report.) To the Ogilvie Range he does not wish to assign definite limits; the name, however, appears on the map accompanying the report near the Arctic-Pacific watershed at the head of the Stewart River.

Although these names can only be considered tentative, and no nomenclature laying any claim to finality is possible before we possess a far more thorough knowledge of the region, all such efforts to define geographic units are to be welcomed because of the clearer conception they lead to of the relations of the parts to the whole. Thus, whatever their name, Keele recognizes the Mackenzie Mountains as a northern member of the Rocky Mountain System. Whether the term should be made to include the whole width of this portion of the Rocky Mountain System between the Central Plateau Region and the basin of the Mackenzie River, or whether it should merely be applied to the outer, or eastern, belt of the System, as the region of low relief lying northeast of the course of the Pelly River and separated from the main body of the Central Plateau Region by the Glenlyon and Pelly Mountains would seem to indicate, cannot at present be decided. W. Joerg.

Denudation in the United States. Messrs. R. B. Dole and H. Stabler have a paper in Water Supply Paper 234 entitled "Denudation" in which they present estimates of the rate of denudation in the United States. The computation of denudation factors are based on figures representing the amount of mineral matter carried by streams, the size of the areas tributary to the streams, and the quantity of stream water discharged. The sources of data are discussed and the summary presents in tabular form denudation estimates for the primary drainage basins and for the whole country.

"The tons per square mile per year removed from different basins present interesting comparisons. In respect to dissolved matter, the southern Pacific basin heads the list with 177 tons, the northern Atlantic basin being next with 130 tons. The rate for Hudson Bay basin, 28 tons, is lowest; that for the Colorado and western Gulf of Mexico, basins, is somewhat higher. The amounts are generally lowest for streams in the arid and semi-arid regions, because large areas there contribute little or nothing to the run-off. The southern Pacific basin is an important exception to this general rule, presumably because of the extensive practice of irrigation in that region. The amounts are highest in regions of high rainfall, though usually the waters in those sections are not so highly mineralized as the waters of streams in arid regions.

"Colorado river brings down the most suspended matter, 387 tons per year for each square mile of its drainage basin. Practically no suspended matter is transported by St. Lawrence river. The Mississippi apparently discharges more material than is brought in by its tributaries, thus indicating that its lower valley is still being eroded.

"The estimates reveal that the surface of the United States is being removed at the rate of thirteen ten-thousandths of an inch per year, or one inch in 760 years. Though this amount seems trivial when spread over the surface of the country, it becomes stupendous when considered as a total, for over 270,000,000

tons of dissolved matter and 513,000,000 tons of suspended matter are transported to tide water every year by the streams of the United States. This total of 783,000,000 tons represents more than 350,000,000 cubic yards of rock substance, or 610,000,000 cubic yards of surface soil. If this erosive action had been concentrated upon the Isthmus of Panama at the time of American occupation, it would have excavated the prism for an 85 foot level canal in about seventy-three days."

THE PAN AMERICAN UNION. The name of The International Bureau of the American Republics has been changed to "The Pan American Union." Its monthly publication has the name "*Bulletin* of the Pan American Union," from the October number.

STATE GEOLOGICAL SURVEY OF TENNESSEE. The legislature of Tennessee provided for the organization of this survey at its last session. Under the law, a State Geological Commission was appointed consisting of the Governor, the Commissioner of Agriculture, the Chief Mine Inspector, the President of the University of Tennessee, the Chancellor of Vanderbilt University and the Vice Chancellor of the University of the South. The Commission has elected Mr. George H. Ashley as State Geologist. He was formerly connected with the U. S. Geological Survey. Mr. L. C. Glenn and Mr. C. H. Gordon have been chosen as associate geologists. By working, like several of the other state surveys, in cooperation with several of the national bureaus, the total product of the field studies will be greatly enlarged. Besides the accumulation of geological data the survey will give special attention to the study of the natural resources of the state. It is expected to issue Bulletins as fast as work is completed.

TWENTY-FIVE YEARS OF THE BLUE HILL METEOROLOGICAL OBSERVATORY. This private, scientific establishment, founded and supported by A. Lawrence Rotch, has now been in existence a quarter of a century. The occasion is improved by the *Technology Review* to print a short paper on the Observatory and its work (Vol. xii, No. 2). It has made a continuous record of the meteorological phenomena, at its elevation of 635 feet, and has long been engaged in the study of the upper air by means of kites. It was one of the first of our stations to be equipped with self-recording instruments, is one of the few in the world where nearly every element is continuously recorded, no other station has studied the upper and lower air so long, many new types of instruments have been made and the long labors and results of Mr. Rotch and his able staff have everywhere commanded attention. While the observatory is still independent of outside control, it is attached to Harvard University and publication is made in the *Annals* of the Astronomical Observatory.

PROMOTIONS. J. Paul Goode and H. H. Barrows, geographers of the University of Chicago, have been promoted from the position of Assistant Professors to be Associate Professors.

AFRICA

THE FRENCH GUINEA RAILROAD COMPLETED TO THE UPPER NIGER. The railroad which, for some years, has been building across the French Guinea Colony was completed, on Sept. 15, to Kouroussa on the upper Niger. It will now be extended about 100 miles further southeast to Kankan. The route extends inland from Konakry, the chief port and capital of the colony. This enterprise will be of great importance in the development of the large resources of French Guinea.

ASIA

Failure of the Chinese Census. According to the "Ostasiatische Lloyd," as reported in *Globus* (vol. xcviii, No. 4), the attempt of the Peking government to enumerate the population in the first year of the new Emperor, is practically a failure. The populace feared that the census was to form the basis for the imposition of new taxation and refusal to give information was general. The enumeration was fairly successful only in the treaty ports and the chief cities and no returns of any sort were received from four of the provinces. Furthermore, no one without a fixed abiding place was counted and so the vast number of boatmen, coolies, wheelbarrow men, beggars, etc., were not enumerated. Under the circumstances, the figures published by the government have very little value.

Dr. Sven Hedin's Scientific Results. The scientific results of Dr. Hedin's journey in Tibet (1906-08) will consist of three volumes of memoirs and an atlas in two volumes. The text will embrace about 1,500 pages and will comprise reports on geographical discoveries and observations, memoirs on the physical geography of Tibet and papers by Dr. Hennig on geology, Prof. Lagerheim, Dr. Ostenfeld and others on botany, Dr. Olsson on astronomical observations and Dr. Ekholm on meteorology and hypsometry. It is expected that the memoirs will appear in 1911, 1912 and 1913 and the Swedish government has voted 75,000 kroner towards the cost of publication. Dr. Hedin's detailed map of Tibet on a scale of 1:1,000,000, will appear in 1912.

Japanese Whaleries. Since the Russo-Japanese war, the whaling industry, formerly flourishing in Japan and Corea, has had a great revival in both countries. Japanese whaling vessels, in the year ending September, 1908, captured 1,784 whales of a value of $1,200,000. The most southern of the whaling ports is Hososhima, in the province of Hyuga and the most northern is the island of Kinkasan, to the northeast of Sendaï, on the east coast of Nippon. The whaling stations of Corea are at Oul-san on the southeast coast and near Wön-san on the east coast. Seven companies are engaged in the business, the largest of which hunts the whale in the Pacific and on the east coast of Corea. The government now authorizes whaling as far as the south end of Formosa where these animals are said to be abundant. Japan proposes to adopt strict rules to prevent the extermination of the whales.

OBITUARY

Professor William H. Niles. Prof. Niles died on Sept. 13 at the age of 72 years and 3 months. He was professor of geology and geography in the Institute of Technology, Boston, from 1871 to 1902 and had been the head of the department of geology at Wellesley College since 1888. Well known as a teacher and lecturer, he was also conspicuous as the author of papers on glacial phenomena and on the geology and physical geography of Massachusetts. He was president of the Boston Natural History Society from 1892 to 1897.

Professor Z. Consiglieri Pedroso. The Society regrets to announce the death of Professor Pedroso, President of the Geographical Society of Lisbon, of which event it is informed by a communication from that Society under date of Sept. 3d, ult.

Prof. Dr. Theobald Fischer. Prof. Dr. Theobald Fischer, professor of geography at the University of Marburg, Prussia, is dead at the age of 64. He was a geographer and teacher of wide reputation.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

AMERICA

The Grand Canyon of Arizona. How to See It. By George Wharton James. With numerous illustrations of points of interest and maps. 8vo, pp. xii and 265. Little, Brown & Co., Boston, 1910. $1.50.

The great division of the long line of chasms of the Colorado River of the West, named in 1869 by Major Powell "The Grand Canyon," has become famous and each year is visited, on the south side of the eastern portion, by thousands of tourists. No adequate guide book existed till Mr. James brought out this one to supply the deficiency. It is elaborately and carefully prepared and there seems to be no point of interest which has been overlooked. The book will be truly invaluable to every visitor in answering the many questions that are certain to arise. There are numerous good photographs in half-tone and a "Detail Map of Granite Gorge Section" which is the part immediately under the terminal of the railway, and east and west from it, for a total of about 35 miles in an air line. The detail is mainly in the place-names, not in the topography, and one is reminded again by these names of the mistaken ideas we seem to have in this country as to proper geographic nomenclature. Our Troy, Rome, Carthage, Athens, Corfu, Cairo, etc., it would appear, should have taught us better, but here in the majestic Grand Canyon region, where simplicity ought to prevail, the grandiose effort is repeated, and we have, alas! Walhalla, Ottoman, Krishna, Shiva, Buddha, Sagittarius, Zoroaster, and an interminable list of like monstrosities applied to buttes and promontories, due to a schoolboy-phase of culture. Anthon's Classical Dictionary is not the proper source for United States place-names.

The first white men to see the great gorge are believed to have been Captain Cardenas and his party of Coronado's expedition in 1540; at any rate, they hold the record. Cardenas has been credited with the statement that the chasm was three or four leagues deep, notwithstanding the absurdity of such a description coming from an educated gentleman belonging to the Spanish nobility. Mr. James quotes this statement on p. 196, from some un-named translator: "they came to the banks of the river which seemed to be more than three or four leagues above the stream which flowed between them." Think of an explorer who could talk of a canyon from nine to twelve miles deep.

The original statement as it occurs in the Castañeda manuscript in the Lenox Library (the source of almost all the information about Coronado and his men) is this: *"a las barrancas del rio que puestos a el lado* (or *bado,* the word is indistinct) *de ellas parecia al otro bordo que auia mas de tres o quatro leguas por el ayre."* The reviewer has compared this transcript with

the manuscript, and with the exception noted as to b or l in *lado,* it is correct. The statement is readily seen to refer to the distance from one side of the canyon's brink to the other in an air line and it has no reference to depth. The distance is actually from 9 to 12 miles. This distortion has been due to careless reading. In Winship's Monograph (14th Ann. Rept. Bur. Am. Eth., Part II, p. 429) the Spanish of this passage is accurately given, with the exception of the b or l as noted above (he gives bado), but when he comes to translate he follows the time-honored mistake, giving the phrase as Mr. James quotes it, and referring in a foot-note to the French translation of Ternaux-Compans, as if that writer's error made the case any better. This reads: "Les bords sont tellement élevés qu'ils croyaient être à trois ou quatre lieues en l'air" (the banks were so high they seemed to be three or four leagues in the air). [Voyage de Cibola, p. 62, Vol. IX, T-C, Voy. & Rel., Bertrand, 1838 ed.] There is no reason to suppose that this author had any other source than that now in the Lenox, a MS. copy, 1596, of Castañeda's original, which has never been reported. This error, perhaps, is of small consequence, but we have gone into the subject here in order to stop its career, in the belief that every error is pernicious. Mr. James, of course, is in no way to blame, as he quoted what he believed to be authority.

As to the canyon itself, Mr. James speaks largely from actual experience, having "knocked about" the region a great deal. He was one of the first to give any extended description of the Havasupais who live in the depths of the Havasu tributary canyon, of which he gives an account in this volume.

The New North. Being some Account of a Woman's Journey through Canada to the Arctic. By Agnes Deans Cameron. xix and 398 pp., many photoengravings and route map. D. Appleton & Company, New York, 1910.

Miss Cameron travelled through Canada, some thousands of miles, from Manitoba to the Arctic Ocean at the Mackenzie Delta. She has written a delightful travel book whose special value lies in its descriptions of development work north of Edmonton. Her photographs of this northern region are among the finest yet assembled and, with her graphic letterpress, they give a clear idea of the routes, settlements, white residents, Indians, Eskimos, trading posts and the bit of farming that has found lodgment in the Peace Valley, 400 miles north of Edmonton, where wheat, oats, barley and vegetables are reliable crops. Among many novelties, she shows the salt beds of Athabasca and the efforts to open the petroleum field in the same region. The book is well worth reading.

Our Search for a Wilderness. An Account of Two Ornithological Expeditions to Venezuela and to British Guiana. By Mary Blair Beebe and C. William Beebe, Curator of Ornithology in the New York Zoölogical Park, etc. Illustrated with Photographs from Life, taken by the Authors. xix and 408 pp., maps showing routes, and index. Henry Holt and Company, New York, 1910. $2.75.

It is a satisfaction to know that the authors of this volume have received pleasure, as well as conferred it, by their studies of the fauna of a portion of South America which is somewhat remote from all frequented routes of travel though it lies rather near to the southern boundaries of our country; that they were powerfully attracted by "the thought of that vast continent [South

America], as yet almost untouched by real scientific research," and have tasted "the supreme joy of learning, or discovering." In explanation of the not wholly obvious meaning of the title, it may be said that the wilderness sought by these authors was one which could be truthfully called an untrodden region—jungles untouched by ax or fire (as they express it), where guns have not replaced bows and arrows; where the creatures of the wilderness are tame through unfamiliarity with human beings.

Their first expedition, in 1908, developed in quite novel fashion the latent interest of mangrove forests in the northern part of the Orinoco delta. Leaving Port of Spain, Trinidad, in a Venezuelan sloop, they cruised among the streams north of that great delta and explored the country around La Brea, the Venezuelan Pitch Lake. Their second "search" was conducted under decidedly favorable conditions, in the forest, river, and savanna regions of British Guiana. Both trips, they assure us, were successful; for the regions they explored were wilderness wonderlands,—"full of beauty, abounding in the romance which ever enhances wild creatures and wild men, and they were part of the great zoölogical 'dark continent' which we hope to devote our lives to studying." Especially interesting descriptive passages are those which relate to protective coloration (pages 17, 18, 341, etc.), the dancing crabs (page 16), and the hunting-ants. Here is a paragraph taken from the account of the last-mentioned marauding army:

"We dropped five big black ants into the midst of the marauders, and witnessed a combat as thrilling as the contest between the Greeks and Persians. Four of the insects alighted on a small rounded stone over which three hunting-ants were scurrying. Without hesitation the black giants fell upon the brown warriors and tore them limb from limb, with the loss of only half a leg. This is not a very serious handicap when one has five and a half robust limbs left! The fifth big fellow dropped upon a mass of ants piled like football-players upon a struggling scorpion, whose sting was lashing the air in vain. The big ant started another ripple upon this pool of death, which soon smoothed away, leaving no recognizable trace of him. But the quartet of big-jawed fellows on their rock citadel fought successfully and well. No ant which crept to the top ever lived to return for help. The four flew at him like wolves and bit him to death. Soon a ring of hunting-ants formed around the stone, all motionless except for a frantic twiddling of antennæ. They were apparently excited by the smell of the blood of their dead fellows, and only rarely did one venture now and then to scale the summit. When we left, two hours afterward, the army had passed, and left the stone and its four doughty defenders, who showed no immediate intention of leaving their fortress." MARRION WILCOX.

AFRICA

Geological and Archæological Notes on Orangia. By J. P. Johnson. iii and 102 pp., 40 illustrations, bibliography and index. Small 4to. Longmans, Green & Co., New York and London, 1910.

A condensed survey of the geology and archæology of the Orange River Colony, South Africa. Mr. Johnson's work both as a geologist and an archæologist in this part of Africa is well known. In this volume he gives a geographical description of the colony, four chapters on the geology, diamond mines and physiography, three on archæology, with drawings of petroglyphs and rock

paintings, one on farming prospects and a bibliography with sixty-five titles. He says that the conservation of moisture in the soil by means of deep plowing is proving successful in the cultivation of the dry lands.

The Handbook of Nyasaland. Comprising Historical, Statistical and General Information concerning the Nyasaland Protectorate. First year of publication. Compiled from official and other reliable sources. 292 pp. and illustrations. The Government Printer, Zomba, Nyasaland Protectorate, 1909. 3s. 6d.

A useful compilation including all phases of the development work in the Protectorate.

ASIA

L'Empire japonais et sa Vie économique. Par Joseph Dautremer, Consul de France. 308 pp., map and illustrations. Librairie Orientale et Américaine. E. Guilmoto, Editeur. Paris, 1910. F. 6.

The two parts of the title correspond to the two principal divisions of the book. It contains, first, a brief outline of the geography of Japan, and, secondly, a survey of its economic resources and activities. Compiled from various official and unofficial sources by the hand of one who knows the country through personal acquaintance, it is a handy guide to the land of the rising sun for the student as well as the prospective trader. One must beware, however, of too readily adopting the author's patronizing attitude towards modern progress in Japan, which betrays the tourist's way of looking at things rather than that of the scholar, the traveler, the philosopher, who tries to understand, and account for, what seems foreign to him. Nations ought to be judged by their aims and ideals, as embodied in their best men, quite as much as by the discrepancy, often ridiculous, between them and the crowd behind the leaders. A Japanese traveling in France, or in any other of the western countries, might make there, eventually, some observations quite as startling as the author records of Japan.

M. K. G.

NEAR EAST

Kairo—Bagdad—Konstantinopel. Wanderungen und Stimmungen von E. v. Hoffmeister, General-leutnant z. D. x and 262 pp., illustrations and map. B. G. Teubner, Leipzig, 1910. M. 8.

The author, a retired German army-officer, has traveled extensively in many parts of the nearer East, some of which are rarely visited by travelers; and he has also supplemented his travels by collateral studies. With his heart full of his favorite subject we can understand that he could not help speaking about it in public, and many a reader of the magazine in which he published his earlier articles certainly has thanked him for a pleasant hour of reading. But it is a pity that successes of this kind too often lead a writer to overestimate his literary and scientific abilities. To write up "the Past and Present of the nature and the people of the Orient," as the author attempts in this book, and to "develop his report into a philosophy of travel," by interweaving it with his personal impressions and reflections, is more than the amateur can ever hope to accomplish. Hence, measured by the ambition of the author, the book is a perfect failure; for the first part of his book he lacks the qualities of the geographer and the historian, and for the latter those of the philosopher.. He is a pleasant

elderly gentleman to whose interesting talks we like to listen, but to whom scientific standards and points of view are entirely foreign. Nothing can, perhaps, illustrate this better than the fact that of the 157 pictures, many of them very good, more than two-thirds are inserted without any indication of what they represent, so that one must look up the index to inform himself about their subjects. The fundamental difference between scientific and amateur work shows nowhere better than in the chapter on the Bagdad Railroad, on which, as a former member of the German army, the author can speak as an expert. That part of his book is really valuable; but the rest is simply a series of pictures and adventures which succeed each other like so many pearls on a string, and of would-be aphorisms which hardly ever rise above the level of commonplace. M. K. G.

AUSTRALASIA AND POLYNESIA

The Year-Book of Australia, 1910. lvi and 781 pp., 5 maps and index. 8vo. Gordon & Gotch, London, 1910. 10s. 6d.

Published under the auspices of the governments of the Commonwealth and States. It is the official record of the statistics, governmental departments, institutions, conditions and progress of Australia.

Wanderings Among South Sea Savages. By H. Wilfred Walker. xvi and 254 pp. 48 plates from photographs and index. Witherby & Co., London, 1910. 7s. 6d.

These are interesting chapters of experiences in Fiji, British New Guinea, Luzon and Borneo; and they are all the more interesting because they are a by-product of the author's serious pursuits as an ornithologist. It will, therefore, be understood that he does not pretend to be a geographer or an ethnologist. He writes of the things that interested him with a confidence that they will interest the readers who feel an attraction to his volume. Thus it comes to pass that he has given a valuable account of his experiences with the Negritos of Luzon and that he has given the best description anywhere in print of the Borneo caves where the birds build their nests for a Chinese soup.

In New Guinea he was particularly fortunate in being able to join a punitive expedition directed against the Dobudura in the interior of the north coast of the possession, a tribe never before visited by white men. There was some hard fighting and the constant excitement of a jungle scouting expedition for wild cannibals. The author enjoyed it all and has given us a narrative which must stand as the beginning of geographical acquaintance with that part of New Guinea. He broke new ground in another direction in the same region; he penetrated inland from Cape Nelson to the swamp-bordered lake in which the Agai Ambu (Seligmann names them Agaiambo) live in houses set on piles and lead a life so aquatic that it was long believed that they were web-footed. Mr. Walker somewhat regretfully disposes of this myth, for he says that they are not web-footed, although he observes "between the toes an epidermal growth more distinct than in the case of other peoples."

The governor of the possession, Sir Francis Winter, who followed Mr. Walker on a visit to the lake people, says nothing about the web or the epidermal growth. Both authorities agree on the statement that the Agaiambo walk so rarely on the ground that they cannot do it properly and their feet bleed when they attempt it.

Such unpretentious records must have a great value in clearing the way for the better knowledge of such unfamiliar lands as those which the author has penetrated. This value is by no means temporary, a record of the things which have interested a traveler may contain matter of much permanent importance. This is strikingly illustrated in this work. In a kampong of Dyak headhunters in Borneo Mr. Walker amused a group of young and old by showing them pictures in an illustrated paper. The manner in which they looked at the pictures, upside down, attracted his attention enough for a brief note.

It happens that this involves a matter concerning which the works on psychology and optics are wholly silent. So far as diligent search warrants the statement, there are but four other references to this obscure but interesting phenomenon. W. C.

EUROPE

Geologischer Führer durch Dalmatien. Von Dr. Richard Schubert. xxiii and 176 pp., 18 text illustrations and a geological sketch map. Gebrüder Borntraeger, Berlin, 1909. M. 5.60.

This little book is No. 14 in the series of geological guides which the Borntraeger Brothers are publishing for the benefit of the traveling public. Anyone who realizes the influence of geology upon the shaping not only of land forms but also of human activities can see what new sources of interest such a guide as this may open to him. The book shows what may be observed, geologically, on excursions from various starting points in Dalmatia; and its helpfulness should be a source of pleasure even to the layman.

Central Italy and Rome. Handbook for Travellers. By Karl Baedeker. Fifteenth revised edition. lxxxii and 525 pp., 19 maps, 55 plans and views and the Arms of the Popes since 1417. Karl Baedeker, Leipzig, 1909. M. 7.50.

This standard guide book, thoroughly brought up to date, is likely to be useful to an unusually large number of tourists during the coming fifteen months. In October, 1911, a week will be given in Rome to the commemoration of the proclamation of the Kingdom of Italy. Fall and winter travel in Italy is increasing every year and is expected to be unusually large next year. In this edition of the Handbook, 364 pp. are given to Rome; and among the many maps, those of Elba, and the environs and plans of Elba, Siena, Montepulciano, San Gimignano and Urbino appear for the first time.

Life in the Orient. By K. H. Basmajian. Third, revised edition. 277 pp., and many illustrations. American Tract Society, New York, 1910. $1 net.

In this edition, new chapters show the present conditions in Turkey, and the pictures, also, are new. This is an authoritative work by a native Turk, who was converted to Christianity in his boyhood, has been many years in the missionary service and writes of Oriental matters as none but a native can do. The book is replete with information on all phases of Turkish life.

GENERAL

Military Map Reading. By Captain C. O. Sherrill, Corps of Engineers, U. S. A. 46 pp., 22 figures and map of Fort Leavenworth, Kan. Fort Leavenworth, 1909. 50c.

This manual is used in the U. S. A. Service Schools at Fort Leavenworth

and has been distributed by the War Department to the officers of the organized militia, 9,000 copies being printed in the first edition. It is an elementary work on the reading and construction of maps, and is fully adequate for the purposes designed. It explains and illustrates scales, contours, hachures, and other elements of map-making, gives map problems, and treats of the determination of directions, orientation of maps, determination of the true meridian, etc. While the book is designed for military classes, most of it will be very helpful to all who may desire to cultivate the reading and understanding of maps.

The Story of the American Merchant Marine. By John R. Spears. 340 pp. and 15 illustrations. The Macmillan Company, New York, 1910. $1.50.

For over twenty years, Mr. Spears has been regarded as an authority on American sea enterprises. The books from his pen are based upon long study of the topics he treats. His facts are always clearly presented, his narrative is interesting and he spares no pains to attain accuracy. In the present volume, he tells the story of our merchant marine from its beginnings, through all the phases of its history and of the depression that has marked this feature of our activities since the civil war.

Physical History of the Earth in Outline. By James B. Babbitt. vi and 229 pp., and Appendix. Sherman, French & Company, Boston, 1909. $1.40.

The title of the book is somewhat misleading. What the author wants to demonstrate is not so much the history of the earth in general as his particular theories on the causes and extent of the glacial period, to which the rest forms merely an introduction. His argumentation culminates in a refutation of the hypotheses of a "geologic" or "cosmic" winter and the existence of a polar ice cap as causes of the glacial period, and he substitutes for them a transverse rotation of the earth which would effectuate changes in the obliquity of the earth's axis and, hence, changes in the location of the Arctic zone and climate. As it appears, from ancient as well as most accurate modern observations, that within the last thirty centuries the poles have turned or moved in a direction at right angles to the axis of the diurnal rotation, this movement may be supposed to be continuous and, if so, cycles of such a rotation would correspond to climatic cycles during which ice ages would alternate at the poles and the equator and migrate, as it were, all around the earth between these two.

In a book like this, however, which is supposed by its author to be ranked as a scientific publication, that author should not play hide-and-seek with his readers as he does here. Not only does the title-page observe the strictest discretion as to the profession, position, or general scientific qualifications of the author, but there is not even a preface to introduce him and his work to us, nor a bibliography by means of which we might assign him his place in the long line of workers on these problems, nor a subject index that might enable us to cross-examine his theories. These omissions are especially regrettable, not only because they will shake the faith of many a reader in the scientific earnestness of the author, but even more because his transverse rotation is a very near relative of another hypothesis long established by Professor Simroth of Leipzig, namely, the "Pendulation Theory," and the principal interest and merit of the book lies in the points of resemblance and divergence that it con-

tains in comparison with that older theory. What Mr. Babbitt wants to prove on geological and astronomical evidence has long been anticipated, for biological reasons, by the Leipzig scholar. The latter does not, however, suppose the transverse motion to be a complete rotation but a pendulation along a swinging plane of which he has even determined the poles: an East pole on Sumatra and a West pole in Ecuador. Between the two, the swinging plane would pass through Bering Straits on the western and through Kamerun on the eastern hemisphere. Yet Professor Simroth's name is not even mentioned in Mr. Babbitt's book, nor is that of Dr. Arldt of Radeberg (Saxony), the noted specialist on the Permian glacial period, a period which, by the way, is entirely excluded from Mr. Babbitt's synopsis of glaciation on the Southern hemisphere. (See review of Dr. Arldt's book, *Bull.*, Vol. 42, 1910, pp. 295-96.) A revised and enlarged edition of Mr. Babbitt's book, which would consider the opinions of living scholars as well as of those of the past, and which would show more definitely the author's position among his fellow scientists in this field, might become a real contribution toward a solution of these much discussed problems.

M. K. G.

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NEW MAPS

NORTH AMERICA

U. S. Geological Survey Maps

Colorado and New Mexico. (a) Map of South Park Coal Field, Col. 1:125,000=1.9 mile to an inch. Black. By C. W. Washburne. [Shows formations, coal mines and prospects]; (b) Map of Colorado Springs Coal Field, El Paso Co., Col. 1:125,000. Black. By Marcus I. Goldman. [Shows geological formations and sections of coal beds on vertical scale of 5 feet to an inch]; (c) Map of Canon City Coal Field, Col. 1 mile=.75 inch. Black. By C. W. Washburne. [Shows formations and coal horizons]; (d) Map of Trinidad Coal Field, Col. 1:187,500=3 miles to an inch. Black. By G. B. Richardson, D. E. Winchester and J. H. Gardner. [Shows formations, distribution and names of mines and structure sections]; (e) Map of Carthage Coal Field, N. M. 1 inch=1.25 mile. Black. By J. H. Gardner. [Shows formations, coal-bearing rocks, coal mines and outcrops]; (f) Map of Coal Field between San Mateo and Cuba, N. M. 1:500,000=7.89 miles to an inch. Black. By J. H. Gardner and A. L. Beekly. [Shows formations, coal-bearing rocks, coal mines and exposures and location of fossils. These maps illustrate *Bull.* 381-C: "Investigations of Coal Fields in Colorado and New Mexico by the U. S. Geol. Surv. in 1908," by G. C. Martin, C. W. Washburne, M. I. Goldman, G. B. Richardson and J. H. Gardner. Washington, 1910.]

Maine. Geologic map of the mineralized area of Bluehill, Brooksville, Deer Isle and Castine, Me. 1:125,000. In colors. Contour interval, 20 feet. 1909. [Illustrates *Bull.* 432: "Some Ore Deposits in Maine and the Milan mine in N. H." By W. H. Emmons. Washington, 1910.]

UNITED STATES. (a) Map showing the principal Manganese Mines and the probable extent of the Ore-bearing Areas in Va. 1 inch=17 miles. Black. (b) Map showing the distribution of Manganese and Manganiferous ore deposits in the U. S. 1:11,875,000=187.42 miles to an inch. Colors. In Pocket. [Illustrate *Bull.* 427: (Manganese Deposits of the U. S., with sections on Foreign Deposits, Chemistry and Uses," by Edmund C. Harder. Washington, 1910.]

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Meteorological Chart of the North Atlantic Ocean, Nov., 1910.

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U. S. DEPARTMENT OF AGRICULTURE MAPS

UNITED STATES. Soil Survey Maps of Tift Co., Ga.; Lincoln Parish, La.; Orono Area, Me.; Auglaize Co., Ohio; Saluda Co., S. C. 1:62,500 and 1:63,360. [In colors, with contours of elevation and descriptive text.]

UNITED STATES. New York City. Routes of the Interborough Rapid Transit Company. 5½ inches=one mile. [Includes the Borough of Manhattan and the parts of Brooklyn and the Bronx served by the subway (red) and elevated (blue) lines. Dockage facilities along the Manhattan and a large part of the Brooklyn, Bronx and New Jersey water fronts are clearly shown and lettered.]

CANADA. Rocky Mountains between Lat. 51° and 53° 10′. 1:253,440=four miles to an inch. 2 Sheets. Dept. of the Interior, R. E. Young, Chief Geographer, Ottawa, 1910.

SOUTH AMERICA

BRAZIL. São Paulo. Carta Geral do Estado de São Paulo. Com indicaçoes sobre a agricultura, commercio, instrucção publica, industria e colonisação. 1:2,000,000=31.56 miles to an inch. In colors. (Preliminary Edition.) Commissão Geographica e Geologica, João P. Cardoso, Chefe. São Paulo, 1910. [Shows communications, telegraphs, industrial centers, distribution of forests and plains, and of coffee, cane, rice, cotton and other plantation crops.]

AFRICA

ALGERIA. Algérie Nord. 1:1,600,000=25.2 miles to an inch. In colors. Dressée par le Gouvernement Général de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation, 1905. [Shows the areas set apart for colonization from 1830 to 1905, concessions of land and forests, centers of native population, military stations, rail and wagon routes, etc.]

ALGERIA. Carte des Divisions administratives de l'Algérie. 1:3,200,000=50 miles to an inch. In colors. Gouvernement Général de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation, Service cartographique, 1910. [Shows areas of territories occupied by communes exercising full or partial political powers, the areas under military control and the Territories of the South.]

ALGERIA. Algérie Nord. Forêts domaniales, communales et particulières. 1:1,600,000=25.2 statute miles to an inch. In colors. Dressée par le Gouverne-

ment de l'Algérie, Direction de l'Agriculture, du Commerce et de la Colonisation. 1905. [Four tints for forest areas.]

ALGERIA. Cartes des Voies de Communication. 3 Sheets: (a) Département d'Alger; (b) Département de Constantine; (c) Département d'Oran. 1:400,000=6.3 miles to an inch. In colors. Dressée par ordre de M. C. Jonnart, Gouverneur Général. Service Cartographique. 1909. [Shows routes in operation or construction, gauge of R.R. tracks, the national and common wagon roads, etc. Distances on the national and rail routes are given for every ten kilometers. An inset on sheet c shows the extension of the railroad in southern Oran to Kenadsa and the branch line reaching still farther south and, at present, terminating at Taghit.]

ALGERIA. Algérie. 1:200,000=3.1 miles to an inch. Contour interval, 100 M. In colors. Sheets 3, Miliana; 4, Alger; 5, Djurjura; 7, Constantine; 13, Boghari; 14, Bou-Saada. Dressée par ordre Monsieur Jonnart, Gouverneur Général de l'Algérie, au Service Cartographique du Gouvernement Général de l'Algérie. Alger, [1908-1910]. 1 franc a sheet. [A good general map of Algeria with large nomenclature, many rail and wagon routes, topography, forest and dune areas, irrigible regions and much minute information as the location of ruins, cemetaries, mills, etc.]

BASUTOLAND. Maseru—Sheet 129-J. 1:250,000=3.95 miles to an inch. Contour interval approximately, 100 feet. In colors. Surveyed in 1906. War Office, Geographical Section, General Staff, London, 1910. 1s. 6d. net.

BRITISH EAST AFRICA Protectorate. (a) Nairobi and the Surrounding Country. 1:62,500=0.9 mile to an inch. Contour interval about 50 feet, 1s. 6d. net; (b) Nairobi, 1:125,000=1.9 mile to an inch. Contour interval, approximately, 100 feet. 2s. net. Surveyed under the Direction of the Director of Surveys, East Africa Protectorate, in 1909, and printed at the War Office, London, 1910. [These maps are among the first fruits of the Topographical Survey in this Protectorate. They are good maps, though, as the field force is small, not of the highest degree of exactitude. Heights, for example, except those of trigonometrical points, are only approximate.]

CAPE OF GOOD HOPE. Geological Map of the Colony of the Cape of Good Hope. 1:238,000=3.75 miles to an inch. In colors. Sheets 32 (Van Wyk's Vlei) and 40 (Marydale). With profiles. Geological Commission, Cape Town, 1910.

EGYPT. Egypt. 1:50,000=0.7 mile to an inch. Sheets: IV–II, IV–III, N.W.; V–II, V–III, N. W.; VI–II, VI–III, VI–IV, VI–V, N. W.; VII–II, VII–III, VII–IV, VII–V, N. W.; XXXIV–VIII, S. E.; XXXV–VII, XXX-VIII, S. E.; XXXVI–VII, S.E.; XXXVII–IV, XXXVII–VII, S.E.; XXXIX–IV, S.E. Survey Dept., Cairo, Egypt, 1908–1909.

GOLD COAST. Map of the West African Goldfields. Compiled by A. J. Clevely from the Gold Coast Maps in 1:125,000, with the latest information of the Mining Companies. 1 inch=4 miles. In colors. A. J. Clevely, 30 Ranelagh Gds., Ilford, England, 1909. £1, 1s. [Names of the gold fields and of the companies working them are given. Means of communications are shown and the area embraced in the map extends from Kumasi to the coast and from the Ankobra river to Cape Coast.]

SOUTHERN RHODESIA. Map of [Southern] Rhodesia. 1 inch=12 miles. With inset of Northeastern Rhodesia, Northwestern Rhodesia and the N. W.

part of Southern Rhodesia. 1 inch=52 miles. Two sheets. In colors. A. J. Clevely, Ilford, Essex, England, 1910. £1, 1s. [This is the latest of Mr. Clevely's fine series of mining maps showing, on a large scale, the location and area covered by each of the mining properties on the Rand, in Southern Rhodesia and in the Gold Coast Crown Colony. Hill features are not shown on any of these maps, as the effort is to make the clearest possible delineation of the mining properties. The inset on the Rhodesia map shows the location of the mining enterprises in the two northern divisions of Rhodesia. The map gives a clear idea of the wonderful growth and spread of the mining industry in this part of British Africa, and of the railroads and rivers that are making them accessible.]

TRANSVAAL COLONY. Map of the Witwatersrand Goldfields. 1 inch=5,000 feet. Two sheets. Seven colors. A. J. Clevely, Ilford, Essex, England, 1909. £1, 1s. [Shows the position and extent of the various mines along about sixty miles of the Rand, from Randfontein on the West to Holfontein on the East.]

ASIA

JAPAN. Geological Survey of Japan. Sheets Hiwasa, Kanazawa, Matsuyama, Nobeoka. Scale, 1:200,000=3.1 miles to an inch. In colors. Contour interval, 40 meters. Tokio, 1909-1910.

EUROPE

EUROPE. Hand und Reisekarte von Europa. 1:7,500,000=118.35 miles to an inch. In colors. G. Freytag & Berndt, Vienna, 1910. Linen mounted, in pocket form, K. 5. [A fine, clear map of the continent with mountains in hachures, heights in meters, limits of river navigation and routes in red with the important places along them.]

AUSTRIA-HUNGARY. Karte der diözese St. Pölten. Herausgegeben unter dem Bischofe Dr. Johannes Rössler. 1:200,000=3.1 miles to an inch. In colors. G. Freytag & Berndt, Vienna, 1910. Mounted on linen with rollers, K. 10. [Full ecclesiastical information in red, imposed upon a very detailed map of the Diocese.]

AUSTRIA-HUNGARY. II. Bezirk-Leopoldstadt. 1:25,000=0.3 mile to an inch; III. Bezirk-Landstrasse. 1:15,000=12.50 feet to an inch; XVI. Bezirk Ottakring. 1:20,000. G. Freytag & Berndt, Vienna, 1910. [Examples of G. Freytag's Wiener Bezirksplankarten, on large scales, for use in the Vienna schools.]

AUSTRIA-HUNGARY. Reise-und Wanderkarte für das Salzkammergut Salzburg und Osttirol. Bearbeitet von G. Freytag. 1:250,000=3.95 miles to an inch. In colors. G. Freytag & Berndt, Vienna. On linen, K. 5.60. [Mountains in brown wash, heights in meters and very large nomenclature.]

GERMANY. Übersichts-karte der Verwaltungs-Bezirke der Königl. Preuss. Eisenbahn-Direktionen und der Königl. Preuss. und Grossherzl. Hess. Eisenbahn-Direktion in Mainz. 1:1,000,000=15.78 miles to an inch. 4 sheets. In colors. Bearbeitet im Ministerium der öffentlichen Arbeiten. Max Pasch Verlagsbuchhandlung, Berlin, 1910. [An official map of the railroads of Germany. Those routes whose administration is centered in Prussia and in some other parts of the empire are colored to show to which administrative district they belong and the cities from which their operations are controlled. Insets of sixteen cities show, in large detail, the lines centering in them.]

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SCIENTIFIC GEOGRAPHY: THE RELATION OF ITS CONTENT TO ITS SUBDIVISIONS

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OUTLINE OF PAPER.

The Criticism of Geography: It should not be possible for any one to say seriously, as was said recently before the British Associa-

tion, that "students of geography are embarrassed by the fact that there is no concensus of opinion as regards either subject matter or method."* Yet a leading English geographer pointed out not very long ago that "the chief problem of geography at present is the definition of geography;"† and, it might be added, the second problem is to fix the respective spheres of its logical subdivisions according to that definition of the whole subject.

That these things should be done is desirable, since many individuals stoutly maintain that geography is not a science at all, and, perhaps with some justification, claim that geographers do not seem to know what geography is and what it is not. In most cases both these contentions are supported by the argument that geography as it is taught and written is not developed about any definite central theory, but that it is merely a "heterogeneous agglomeration of dissociated items" or scraps of information, which are dealt with more elaborately and in a truly scientific manner by astronomers, geologists, zoölogists, botanists, historians, and the like.

Logical Concept Needed: The objections raised against geography, where they are justified at all, are usually based on the character of studies and teaching by those whose geographical training has been inadequate, or who have not formulated any clear or logical concept of what the subject really is. It was pointed out some time ago by Davis that, "we may often benefit by systematically setting forth the place of our individual studies in geography as a whole . . . But it is manifest if we should attempt to make exposition of our ideas concerning the relation of our own studies to the whole subject, we must have previously gained a tolerably definite idea of the nature of the whole."‡ The failure to recognize the significance of that statement furnishes the explanation for much of the trouble encountered by geography, since with an erroneous concept of geography as a whole, it is certain that there will be erroneous interpretations of any particular phase of the subject, and a misuse of items under that head.

Value of a concept with a central theory. To Geography as a Science: If the two contentions of the critics of geography are considered in detail, it appears that both can be rendered unfounded, without much difficulty, and with no damage to the subject. The main contention that geography is not sciencne at all, but merely a grouping of dissociated items, is no longer tenable, if all its items are

* Hoke, G. W. *Scot. Geog. Mag.*, 1907, p. 64.

† Mill, H. R. *Bull.* Amer. Geog. Soc., vol. 36, p. 658.

‡ Davis, W. M. *Jour. Geog.*, April, 1906, p. 145.

selected with reference to, and developed about, a central theory, into a logical, coherent whole. To accomplish that end geographers as a body must adopt some one scientific concept of the subject and develop it uniformly along that line of thought.

The second contention, that geographers deal with many items which belong to, and are more adequately treated in, other sciences, can perhaps never be eliminated entirely. Apparent overlapping, one subject with another, is likely to exist always in the case of closely related fields, but it usually does not occur to the critics of geography that the so-called borrowing is not all one-sided. Thus if the geographer were to read out from history all matters concerning location, extent, distribution, climate, surface form, population, products, and so on, as belonging to him alone, history as an intelligible study, would be dealt a crippling blow. If the same process were applied to zoölogy and botany those subjects would be reduced practically to systematic morphology and embryology, and the theory of evolution, like the whole important field of ecology, would have no basis on which to stand. Political science and economics could not be taught at all except in their theoretical and abstract aspects. Duplication to some extent is unavoidable, but it is essential to recognize that it is duplication merely in the thing used, not in the method of treating that thing or in the use to which it is put. Thus the second contention likewise can be rendered unfounded by the same course as will remove the first—that is, by the establishment of a concept of geography which gives it a central idea or theory, and by building around that theory a structure of items, every one of which harmonizes with the theory and may be grouped with reference to its particular bearing on the whole subject.

In expansion of the subject: Geography is steadily receiving more recognition in this country, and as its recognition increases, the subject is constantly expanded to meet the new demands put on it as a background for all the humanitarian studies. This rapid broadening of the field of work presents a main cause for the contention that geography "lacks the coherence essential to a science that is to hold together," for in its expansion, geography as a science has suffered at the hands of those. who, with little or no interest in the subject as a whole, have asked it to do too much in special fields. It is apparently only by the general adoption of some one concept of geography that the exact sphere of the growing subject may be clearly indicated, and the subject saved from those over-zealous friends who would have it do everything. In the light of such a concept, the separate fields of geographical study may then be marked out in a

way which will indicate what is and what is not to be grouped under their heads.

Concepts of geography. The non-geographic: In seeking for a concept of geography which will make it possible to develop the subject as a true science, it may be profitable, from among the multitude advanced, to begin with the statement of a concept which is confused and illogical, and which represents fairly the attitude of many of those not entitled to the name of geographer. One of the most elaborate discussions of geography, by an economist, presents the idea that "systematic geography constitutes a series of descriptive studies of *natural phenomena*."* This concept of "descriptive studies" is expanded somewhat by the subsequent statements that "botanical geography . . . describes the distribution of plants," "zoögeography describes the distribution of animals," and "anthropogeography . . . describes the distribution of mankind." Apparently, therefore, the series of descriptive studies of natural phenomena which constitute geography are concerned simply with the *"distribution"* of plants, animals, and man. But immediately thereafter the writer advances the astounding criticism that "for a descriptive study of *human activities* no category is apparently provided,—unless, perhaps, anthropogeography can be stretched out sufficiently to serve." The concept of geography implied in this last statement obviously discards the idea of natural phenomena, as expressed in the earlier definition, and shifts from the idea of simple *distribution in space* for the plants and lower animals to the idea of the complete description of the *activities* of the highest animal, man. Such a mixed concept can lead only to confusion in the mind of author and reader alike, aside from all question whether geography is "descriptive," whether it is concerned mainly with the "description of distributions," or whether all "human activities" must be covered by the subject.

The persistence of such concepts, however, is one of the fundamental causes for much of the criticism directed against the study as it stands to-day, since with the wrong concept in regard to the whole subject, contributions to geography, the teaching of it, the delimitation of its different fields, and even the criticism of it cannot be done intelligently. It is one of the duties of geographers as a group to adopt so definite a stand in regard to what their subject undertakes to do, that such mistaken concepts can no longer persist.

The distribution concept: Among geographers themselves it has been said that "all are agreed that the subject matter of geography

* Keasbey, L. M. *Pol. Sci. Quart.*, 1901, p. 83. (Italics are mine.)

is the surface of the earth together with what is found on that surface, and there is further general agreement in the view that it includes as an essential part an inquiry into causes affecting these things."* In spite of this "general agreement," however, there is apparent difference of opinion on the two sides of the Atlantic, with some in this country leaning toward the European idea. The line of division is concerning the attitude to be adopted in treating "the surface of the earth and what is found on that surface."

European geographers make the central thought "distribution in space" as may be indicated by representative continental and English definitions. Hettner, whose recent concept may be taken as representative of the modern continental group, makes geography "the science of the arrangement of things in space on the earth."† Except in phraseology this definition differs little from the statement by Mill that "geography is the science which deals with the forms of relief of the earth's crust and with the influence which these forms exercise on the distribution of all other phenomena."‡

The best criticism of these "distribution" concepts of geography is found in the answer that "location and distribution must always be important elements in geography" but that if geography is only the science of distribution, it becomes "merely the regional aspect of other subjects" and it is, therefore, "hardly worth while to maintain the study of geography apart from that of the subjects whose regional aspect it considers."§ No unifying principle in the form of an adequate central theory is contained in the concept of geography as distribution alone, hence there is no basis on which it may be made either coherent or logically systematic. Geography as a purely descriptive study of distributions. therefore, has nothing which can justify a claim to rank as a separate science.

The relationship concept: An adequate central idea or theory which does unify the subject, is found in the concept furnished by Davis, who says "the whole content of geography is the study of the relation of the earth and its inhabitants" or "the study of the relation of the earth and life."|| This concept is perhaps the one held most generally by American geographers, as having the evident advantage of giving coherence, and of setting a logical limit, to the field of geography, since those things, and only those things, which enter into relationship with the earth are rightfully to be considered.

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* Chisholm, G. G. *Scot. Geog. Mag.*, 1908, p. 565.

† *Geog. Zeitschrift*, XI, 1905, p. 554.

‡ Mill. *Scot. Geog. Mag.*, 1901, p. 508.

§ Davis. *Jour. Geog.*, 1906, pp. 149–150.

|| Davis. *Proc.* Am. Phil. Soc., XLI, No. 170, 1902, p. 239.

The idea that the essential principle of geography is relationship between the physical environment and the environed organism is criticized by English geographers and by a few in this country as leaving out "the consideration of place; an essential consideration in geography."* This criticism, however, finds justification only in an unwarranted narrow interpretation of the original definition, since obviously the question of distribution is one of the fundamental points in the study of the relation of the earth to life, wherever that distribution, or place consideration, has any relation to the environment. If, on the other hand, the study of distribution in geography is not limited to those things whose place relations are concerned with natural phenomena, geography is reduced to absurdity and can be held accountable for the place relations of all human activities, even to the distribution of musical instruments and works of art.

That the relationship concept really gives no foundation for the contention that it ignores place, appears in a later discussion, where it is said, "any statement is of geographical quality, if it contains a reasonable relation between some inorganic element of the earth on which we live, acting as a control, and some fact concerning the existence or growth or behavior or distribution of the earth's organic inhabitants, acting as a response."† Thus the idea that geography is the study of the relation of the earth to life makes full allowance for all that the European concept of distribution can logically claim. In addition it changes the emphasis from mere description to scientific explanation, broadens the field materially, yet sets definite bounds for it, and perhaps most important of all, it provides the unifying principle of relationship, about which the subject may be developed as a true, organized science.

The further objection that the aim of geography is concerned more especially with human life, rather than with life in general, as directly implied in Davis's definition, cannot be raised seriously, since those who insist on the super-importance of the man element in geography lose nothing by adopting the broader concept. The human relations may be studied just as readily and just as exhaustively as a special field of the broader subject, and at the same time they may receive material assistance in their own statement by the development of allied fields in connection with other forms of life.

Finally, the objection that such a broad concept makes the subject too vast for any one man to handle is no discredit to geography as a

* Chisholm. *Scot. Geog. Mag.*, 1908, p. 571.

† Davis. *Jour. Geog.*, April, 1906, p. 149.

science, any more than it discredits chemistry to have workers in the special fields of organic, inorganic, physical and even physiological chemistry. Because of its many-sided relations the content of geography is perhaps more complex than that of most other sciences, and hence likely to be marked by more subdivisions and separate fields of study. But it is more desirable, than otherwise, that there should be recognized special phases of geography for which special training is required. Under such conditions the whole science can much more readily be advanced, if those special phases are developed, first, according to a common concept of the whole subject, and, second, with a proper understanding of the logical relation of each phase to its fellows.

Significance of relationship: Accepting the relationship concept of geography it appears possible to define the provinces of the various specialized fields of geography with a degree of clearness not attainable under the narrower distribution idea. At the same time it is possible to indicate the relation of the different fields to the whole subject and to each other, and to arrange them all in an orderly system or logical grouping, such that, when each field has been developed to its full extent, the result will represent the complete structure of a systematic, unified science of geography. Such a definition and grouping of the special phases of geography seems to be the only way to free the subject from the many criticisms directed against it, and above all to demonstrate clearly that geography, properly interpreted, is a coherent science, capable of standing on its own merits.

General divisions of geography under relationship concept: The first natural line of division in geography lies in the recognition that one side deals with the inorganic environment and the other with the organic responses. The line of cleavage between these two sides is sharp enough so that there is little room for question regarding their relative spheres. Each side, however, is so broad that it, too, is capable of being split into various subdivisions, any one of which may be made the sole subject of individual study. Designating the whole inorganic side by the comprehensive term, physiography, and the entire organic side by the corresponding term, ontography, the special subdivisions of each may be regarded in their relation to each other, to these main divisions of the subject and to scientific geography as a whole.

Physiography and its subdivisions: So far as the inorganic side is concerned, the content and subdivisions of the subject are readily marked out according to a natural four-fold grouping. Thus there

are the three chief elements of the physical environment, to which responses may be made, the land, the air, and the water. To these three must be added the fourth group of conditions which may induce separate responses of life, namely, those earth relations which are the result of the earth being a member of the solar system, and which are usually collected under the unsatisfactory name of mathematical geography. It is, however, in itself, not a "geography" at all, nor is it mathematical, beyond the fact that recourse is had to mathematics in explaining some of the items. The use of such a term for a sub-head of physiography is entirely illogical, and hence some better term may be sought. It may be suggested that *geoplanetology,* or the study of the earth as a planet, would be a more appropriate designation, since it is really the planetary aspects of the earth which are the chief aim of the study. This term has the added advantage of being uniform in character with the adopted names of the associated studies. Furthermore, under the head of the planetary aspects of the earth, place may be found for the logical grouping of certain items, such for example, as the arrangement of land and water, which mathematical geography does not include, and which can not be readily placed under the head of the physiography of the lands. Meteorology, oceanography, and physiography of the lands, represent the three other phases of general physiography.

The logical grouping: In erecting the system in which these four divisions are to stand in logical relation one to another, certain conditions of inter-relationship make an absolutely logical progression impossible. Thus the study of ocean currents under the head of oceanography involves in their complete explanation a previous understanding of certain phenomena of the atmosphere, especially winds. The study of the physiography of the lands is dependent on meteorology for the full explanation of some of its important aspects, while in turn, meteorological phenomena are to a certain extent influenced by land and water conditions. The grouping which is adopted, therefore, must be the one which does least violence to the inter-dependent features of the subject.

It is obvious that the group of planetary earth relations, or geoplanetology, is independent of the others, so far as its own things are considered, whereas both meteorology and oceanography depend upon it in several important particulars. Hence it may be regarded as the basis from which the system is to start. Meteorology especially bears an intimate relationship to the planetary qualities of the earth, its phenomena are more nearly planetary, and it is necessary for the explanation of some aspects of both oceanography and physi-

ography of the lands. For that reason the study of meteorology is logically the second sub-head under the general subject physiography. Oceanography, through tides related to the planetary aspects, and through waves, currents and so on related to meteorology, is somewhat closer to both these than is the study of land forms. Consequently, oceanography and the physiography of the lands stand third and fourth respectively in formulating the order for the consideration of the special fields of physiography with reference to a logical system of scientific geography.

It must be recognized, however, that even though these four subdivisions provide under one head or another for the study of all phenomena entering into the physical environment, they do not furnish all that is needed in the correlation of inorganic environment and environed organism. As here presented, the critically important element of climate is not provided for. It is true that the explanation of the individual phenomena which enter into a climate is included under the head of meteorology, but meteorology, however necessary for an understanding of climates, does not and can not properly give any adequate idea of the different climates which are so important in their influence on life responses. Furthermore, the study of climates is not necessarily to be considered as a sub-head of meteorology, to be studied under that head, simply because it draws much of its data from that field. Climate has much to do with the planetary characteristics of the earth, aside from its relations to that field through meteorology. Climate is also concerned very intimately with certain aspects of land and water conditions. For these reasons, it seems that in any logical scheme of geography, the study of climates must be included as a sub-division of general physiography, along with the four already mentioned, and it must come after the study of those other divisions. Climatology, therefore, becomes the fifth and culminating department of physiography. In support of this arrangement it may be argued further that, in addition to conforming as nearly as possible to the logical order of sequence, it brings at the end of the physiographic list those particular phases of the inorganic environment—the surface of the lands plus climates,—to which organic forms show the most intimate, most numerous and most complex relationships.

Ontography and its divisions: Confusion. On the other side of geography, that is, ontography, the sub-divisions are more complex, they are comparatively less fully developed, and they lack uniformity and system. It is perhaps a natural outcome of the complexity of the subject that there should be temporary confusion on the organic

side and hence delay in evolving a systematic classification corresponding to what has been done for physiography. Yet it seems more likely that this absence of a logical grouping for the departments of ontography is the result of two other chief causes: first, the failure to establish a logical concept of geography as a whole, around which the entire science is to be built, and second, the general tendency to over-emphasize the different phases of the subject dealing with human life, without seeing their proper relation to the other co-ordinate aspects of the subject.

Under the concept that geography is the study of the relation of the earth to life, all forms of life responses must be provided for in the ontographic grouping. At the same time, moreover, any careful consideration of the relation of the earth to human life,—to which many are inclined to limit the subject,—will reveal immediately that such a restriction of the field not merely narrows the study, but renders even that part incapable of its full development. Life is so completely a unit that it is not possible to include some forms and ignore others if the human side is to be made intelligible. Thus, for specific example, man in the dry deserts of the world, is one of the plainest products of environment to be found, but he can not be considered intelligently in the true relation to his environment without a prior understanding of the relation of the desert conditions to the other forms of life which react on the human being.

The classification of ontography is further hampered by the tendency of many, especially those who come at geography from the outside, to split off a part of the real content of ontography, and use it, with outside material, for special consideration yet under the general name of geography. Few, if any of these, have undertaken, even in their own minds, the task of erecting ontography into a coordinated system, one part of which is related to the others, and each of which harmonizes with a scientific concept of geography as a whole.

Finally, much of the work which is now grouped more or less indiscriminately in the ontographic field has been done not by geographers, but by others,—historians, economists, biologists, and the like,—who have desired the geographical relations mainly as a background for their own special lines of endeavor. For that reason the nature of the work has been colored by the special subject from which the investigator came, and the scope of the various sub-divisions of ontography has often been indicated with reference to this outside emphasis, rather than having the work and the scope represent a product guided by a broad concept of the real field of geog-

raphy. The definition and grouping of the ontographic fields, in a co-ordinated system of scientific geography, therefore, though making use of existing terminology, frequently involves radical disagreement with many of the concepts which have been advanced from one side or another.

Terminology: Among the many terms already invented to cover special phases of ontography, the most used, the ones generally accepted, and worth considering, are phytogeography, zoögeography, anthropogeography, economic geography, commercial geography, historical geography and political geography. Such terms as "social," "moral," "business," "applied" geography and so on are not here considered as having sufficient individuality to warrant their inclusion as separate fields. Concerning some of the recognized aspects of the subject, especially the last four in the above list, there is much discussion as to the field covered, and their relations not only to geography but also to the subjects from which the qualifying adjective is borrowed.

The main logical divisions of Ontography: The grouping of these sub-divisions of ontography must be made in accordance, first, with the concept that geography is the study of the relation of the earth to life, and second, with the principle that life is a unit, in which the higher types are reacted on to a great extent by the types lower in the scale. Thus the relations of human life to its physical environment are both direct and indirect, the latter coming through man's relations to the lower forms of life which are indispensable to his existence. For this reason, the consideration of the human phases of ontography can not be made the primal consideration in the organized science. Since, moreover, what is true of man, as the highest animal, is to a greater or less degree true of most lower types of animal, the basal consideration must begin still lower down with the responses of plant life.

It appears at once, therefore, that there are three logical main divisions of ontography, according to the division of life into the natural groups, plants, animals, and man, the justification for the last division resting largely on our greater interest in the complex and multiple responses of our own genus. There are, then, as a basis from which to start, the three co-ordinate subdivisions of ontography: phytogeography, zoögeography, and anthropogeography, standing in their logical order of inter-relationship or dependence.

Phyto- and Zoögeography: As for the field covered by the first two divisions, there is a more or less common inclination to limit them to facts of distribution alone. This attitude is indicated by the

typical definitions quoted above, to the effect that "zoögeography describes the distribution of animals" and so on. Such an interpretation of phyto- and zoögeography can not be harmonized with the concept of geography as a whole, which is to crystallize the entire body of the subject into a systematic science. It is necessary to expand the idea to include also the habits and characteristics of plants in so far as they arise from the conditions of their environments. Thus the consideration of why desert species include few important seed producing types and why the most prolific seed producers are found in largest numbers in the warm and moist localities, are not only important responses of plant life to environment, but are also fundamental factors in the relation of human life to its surroundings. Phyto- and zoögeography, therefore, must be broadened beyond the simple concept of distribution of families, genera and species, in space; and both these fields must be developed along the broader lines before the full statement of anthropogeography is possible.

Anthropogeography. Its scope: Anthropogeography may be taken as the culminating, just as it is logically the last, main division of geography in the systematic grouping. The various concepts of anthropogeography differ widely in the breadth of view. A broad concept regards the subject as seeking "to devise an elucidative connection between the separate geographical frameworks and the history that has been erected and the civilization that has been worked out with them."* This definition apparently makes anthropogeography include all of ontography except the co-ordinate fields of phyto- and zoögeography. An intermediate definition states that "anthropogeography describes the effects of the environment in constituting the organic variations which have occurred in the course of human development,"† and cites as examples the shape of the head, pigmentation of the skin, texture of the hair, color of the eyes, stature, physique and the like—that is, relations all of which are morphological in character. Most narrow of all is the common idea that anthropogeography is the study of the "distribution of mankind," thus harmonizing it with the common concepts of the two other branches of ontography.

This last concept of anthropogeography, however, may be regarded as the result of first, the distribution concept of geography as a whole and second, the confusing of that term with *anthropography,*—without the *geo,*— or that branch of anthropology which

* Eckert, M. *Scot. Geog. Mag.*, Vol. XXIII, 1907, p. 562.
† Keasbey. *Pol. Sci. Quart.*, 1901, p. 483.

avowedly treats of the distribution of the races of mankind and their local variations. The relation of these different phases of life study may be shown graphically by the following method of grouping:

SCIENCE—BIOLOGY:	VARIATION AND DISTRIBUTION:	SCIENCE—GEOGRAPHY:
Study of the thing itself,		Study of Relationship,
Phytology (botany),	Phytography,	Phytogeography,
Zoölogy,	Zoögraphy,	Zoögeography,
Anthropology.	Anthropography.	Anthropogeography.

As indicated by this grouping, phytography zoögraphy and anthropography stand between biology on the one hand and geography on the other, but since they use geographical things, essentially locations alone, mainly in biological relations, they may be considered merely as the regional aspects of their respective subjects, and distinctly apart from the corresponding phases of geography where the idea of relationship is the dominant consideration.

The three primal phases of ontography, therefore, are not to be regarded merely as descriptions of distributions of life forms, but must be interpreted in the broader sense of including every sort of life response to the physical environment.

Its Divisions: If anthropogeography is defined as the study of the relation of man to his environment, it is necessary to group under that general head the various subdivisions of the human aspects of geography,— a number of which are already extensively developed and distinguished by separate names. Economic, commercial, historical, and political, geography, for example, thereby become merely specialized fields of investigation for the anthropogeographer. They are not any longer to be regarded as co-ordinate with that subject or with phyto- and zoögeography, both of which latter phases may themselves have subdivisions analogous to these subordinate aspects of anthropogeography.

It is around these subordinate phases of the human side of the subject, however, that most of the recent discussion has centered, from which most of the criticism of geography as a science has arisen, and with respect to which there is perhaps the greatest need for a systematic grouping in accord with the concept of geography as a logically organized study.

Economic and commercial geography: There is such wide diversity of opinion as to what is the field and the relationship of some of these special subjects, that it again is necessary to fix their limits with respect to subject matter before they afford any definite or common basis for grouping in the whole plan of geography. Most

of the uncertainty hinges about economic and commercial geography, which by some are regarded as essentially synonymous terms, and by others are held to be distinct and separate. In this case also it may be most instructive to begin with a concept formulated by one not a geographer, for, at the same time, it illustrates, perhaps better than any other, the way in which confusion has been introduced into the subject.

Economic Geography: The Economist's Concept: In answer to the self-asked question, what is economic geography? this writer first concludes that it is not commercial geography, and then goes on to say, "Our friends the geographers would doubtless answer, economic geography traces the influences exercised by the physical environment on economic activities . . . Economic geography does that and much more: it seeks to ascertain and explain the *geographical division of labor**—that is, the localization of industries, in terms not alone of the physical environment, but of all the factors involved, cultural as well as physical . . . nor is any fact excluded which bears on the geographical division of labor, *however remote it may be from the physical environment.*"*† This concept is worth following in its further elaboration as follows: "Economic geography will, therefore, consider first, under the head of *natural** controls, how relief, climate, soil, minerals, and other natural resources, influence the geographical division of labor. It will next consider, under the head of *human** controls, race, religion, languages, nationality, and government, in so far and only in so far as they affect the geographical division of labor. And finally it will consider, under the head of *economic** controls, to what extent transportation, the machinery of exchange, the supply, skill, and standard of living of labor, the supply, efficiency, and cost of capital goods, the organization of the factors of production, the methods of production, the principle of competitive and complementary industries, and other economical factors, determine the geographical division of labor."‡ Arguing from these premises the writer then draws the startling conclusion that "economic geography is *not a part of geography* . . . but an *integral part of economics*"* and treats his readers to the amusing deduction that "for the same reasons, it would appear that economic geography *can not be adequately handled except by a trained economist.*"§

So far as this concept is concerned, no one, least of all a trained

* Italics are mine.

† Robinson, E. V. *Pub.* Amer. Econ. Ass'n., Vol. X, No. 1, 1909, p. 5.

‡ Robinson. *Ibidem*, p. 6.

§ Robinson. *Ibidem*, p. 10

geographer, would dispute this last contention. A coherent science of geography, can by no logical process of reasoning be made to include such items as the consideration of the "machinery of exchange," the "efficiency of capital goods," or the "organization of the factors of production," "however remote from the physical environment." It is immediately obvious, from a glance at the things enumerated, that the concept is that of a trained economist, who is defining, not economic geography, with a concept of general geography in mind. but who is defining, regional economics, with a very clear concept of general economics in mind. Unfortunately, however, just so long as things may be written and taught, according to such concepts, and put out under the guise of geography, no matter what the qualifying adjective, just so long must geography be open to the criticism of encroaching on other subjects, lacking co-ordination and any unifying central theory.

Any phase of study bearing the nounal designation geography is to be defined in terms of geography, and not in the terms of the subject from which a qualifying adjective may be drawn. It may be worth noting, for example, that economic zoölogy and economic geology are accepted designations of special phases of their respective subjects and their definitions are made in terms of zoölogical and geological relations—not with respect to economics. The above concept, therefore, may be held simply as a sample of what economic geography is not.

Another typical definition which comes from the economic group is less objectionable, but fails to fit into the orderly plan of scientific geography. After an attempted separation of man from the lower animals on the basis of psychic differences this writer concludes that it is the "physical environment which determines the nature of the beast and the economic environment which occasions the character of man."* "Economics . . . may consequently be accepted as the fundamental criterion of civilization" . . . and "granting this, scientific geography requires the economic element to complete its classification and carry its descriptive study into the realm of human affairs." Going on with his analysis, this writer points out that the two important aspects of economics are the question of supply and of demand, the latter being the result of psychic phenomena and the former being controlled by physical phenomena. The definition of economic geography, therefore, becomes, "the *descriptive* study of the natural resources of the earth *in their application,*† through the

* Keasbey. *Pol. Sci. Quart.*, 1901, p. 87.

† Italics are mine.

processes of production, distribution and exchange to the satisfaction of human wants."* This concept, by placing the emphasis on *use,* and simple *description,* appears to be phrased with the idea that economic geography is to serve as an introductory study to economics, rather than to take its proper place in a system of geography as a perfect and exact science.

Both the foregoing definitions, which may stand as types of their group, suffer because the presence of the qualifying adjective, "economic," has led to the impression, among economists especially, that the definition of the subject must be made in the terms of the science of economics rather than in the terms of a science of geography.

Geographer's Concepts: "Distribution" Group. From these unsatisfactory concepts, placing the emphasis on the economic, rather than on the geographic, it is not a very long step to a concept held by many geographers, especially among those of the European group. In a recent discussion of economic geography before the Scottish Geographical Society, Chisholm advanced no specific definition of the scope of the subject, but implied his concept in his choice of illustrations. First, they were taken from the field of production, "that department of economic inquiry in which the relations between geography and economics are probably most numerous and closest,"† and in which the "simplest case . . . is the production of agricultural commodities for local consumption." Next the idea of transportation and trade was included, as indicated by the discussion of the wheat districts of Canada, Argentine and Siberia, with the remark that "in facilities for reaching over-sea markets, however, the three areas differ very greatly."‡ At the same time the importance of the effect of the "nature of the commodity" was considered, in the case of trade to foreign markets, while under the head of further considerations affecting the "transport and exchange of commodities"§ special emphasis was placed on the effect of the "carriage of bulky goods in cheapening the carriage of the less bulky." By way of illustration, a long analysis of British trade was brought forward. As a final element in the field of economic geography, the discussion of the factors influencing the "localization of industry," was taken up with reference to the character of the materials, the labor supply, local market and so on. A specific example of the items treated is found in the statement that the "proportion of the fuel cost in the

* Keasbey. *Ibidem*, p. 81.

† Chisholm. *Scot. Geog. Mag.*, XXIV, 1908, p. 114.

‡ *Ibidem*, p. 116.

§ *Ibidem*, p. 119.

cost of the finished article must be important in deciding the most important seat for industries."* Thus though no set definition is framed, economic geography, by implication, is concerned with the whole wide range of questions involved in the subjects of production, transportation and consumption.

It is immediately evident that such a concept of economic geography, can not be harmonized with the dominating principle of relationship between environment and life response, nor can such an economic geography be a part of any unified science of geography. Even if economic geography is to deal with some phases of production, transportation and consumption, it can not be held responsible for explaining all the facts of industry and commerce, any more than it can be held accountable for all the facts of history or other human activities. In the last quotation, for example, as to the effect of "fuel cost, etc.," the thing dealt with is clearly not in geographic relations, but stands simply as an item in the problems of industrial processes and costs. It is a case of dealing, not with economic geography, but with industrial economics. This error may be directly traced to the concept that geography must explain the distribution or place of everything, a concept which when applied, as appears here, can lead only to absurdity.

"Relationship" Group: A definition of economic geography which does fall in line with the scientific concept of geography, is found in the brief, but effective, statement, that "economic geography is the description and interpretation of lands in terms of their usefulness to humanity," and that its "net result is the understanding of the *relationship*† between the people of a district and their physical environment."‡ Such a definition not only recognizes the controlling idea of relationship in geography, but also immediately indicates where economic geography must be placed in the general grouping—namely, under the head of anthropogeography, as affording the basis on which human progress is to be interpreted. Furthermore, this definition alone makes possible a broad concept of economic geography, since it minimizes the narrow idea of actual use. The question of "the usefulness to humanity" is a thing quite apart from the mere consideration of application of material, etc. That this aspect was clearly recognized in framing the definition is indicated by the further significant statement that "in economic geography, resources become almost as important as products, because resources of to-day make industries of to-morrow" and in the "explanation and proper

* *Ibidem*, pp. 117–118. † Italics are mine.

‡ Smith, J. Russell, *Bull. Amer. Geo. Soc.*, 1907, p. 472.

estimate of resources lies the kernel of economic geography."* Production, and its resulting activities, must admittedly, so far as it shows relationship, be considered as a part of economic geography, but it is only a part.

Definition and place of Economic Geography: Economic geography may be regarded as concerning itself with those relations which hinder or favor human progress; such as the effect of climate on the requirements of food, the control of the distribution of food products, the relation of topography to the discovery and winning of useful minerals, the relation of surface configuration and climate to the use of the soil, and so on. The definition quoted above might then be recast to read, "economic geography is the study of the different types of environments in the relations they bear to the activities of human life." Under such a definition any particular region may be studied, as representative of a given type of environment and its value to human activities may be carefully estimated, entirely apart from any actual development, use, or application of resources by human inhabitants. This definition, furthermore, is radically opposed to the idea that economic geography is essentially the consideration of the geographical division of labor, or deals extensively with such fields as the medium of exchange and the localization of all industries.

Such a concept, as stated here, gives economic geography a definite basis on which to stand, a character in harmony with the concept of geography as a co-ordinated science, and importance enough to insure it a prominent place in the study of the subject. At the same time it lifts economic geography from a plane where it can be "treated only by a trained economist" to a plane second to none in the special fields of true geographical investigation. Economic geography, according to this concept, stands first, and most important, of the subdivisions under the head of anthropogeography, as furnishing an estimate of the varied physical foundations on which man has risen above the savage animal and based his upward course in civilization.

Commercial geography. Its faults: Commercial geography, which is often confused with economic geography, is perhaps the special field of the subject which at present is in the most chaotic state, with all manner of justified criticisms directed against it. Most of this criticism is based on the character of the text books of commercial geography, the majority of which were not written with any reference to a system of geography. For this reason they have tended to degenerate into a series of "convenient repositories of

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* *Ibidem*, p. 111.

useful information," thus, in a measure, living up to their common ancestry in a German work which was designedly framed to set forth a mass of items "useful for the merchant to know." The line of reasoning from "merchant" to "commerce," and then to "commercial geography," to designate this body of non-descript items is obviously the result of the distribution concept of geography, which would include the place relation of anything or everything.

Commercial geography, as a part of scientific geography is concerned simply with the relations of the earth to the movement, circulation or exchange of utilities. It, therefore, depends intimately on economic geography, and may for many reasons be considered as merely a special phase of economic geography.

As a sample of the extent to which the subject gets away from this simple and logical concept the following items may be taken as typical. In a discussion of commercial geography printed some time ago, the trade of Glasgow was analyzed at considerable length. After stating that raw sugar imported from the Baltic ports is sent "by rail to the Greenock refineries," the discussion continues—"It is curious that the refined (and accordingly more valuable) sugar that comes from the continent to the same ports, when destined for Glasgow, is sent by canal, *the explanation being, no doubt,** that the canal barges are more convenient for delivery to the Glasgow warehouses than to the Greenock refineries."† Such an item may well be "curious," but it can not be regarded as belonging to commercial geography unless difference in the physical conditions of the two places is the real reason for this minor difference in the transport of the goods. Instances of this sort might be multiplied indefinitely, and with even greater inconsistency as for instance in the all-comprehensive estimation of the subject by a German geographer, who would include among the many things which the commercial geographer must know, such items as the water supply, the state of decomposition of the different kinds of rocks, the regional distribution of the different kinds of roads, and the average duration of journeys.‡

Definition of Commercial Geography: If commercial geography is to be held accountable for a description of all exchanges of goods, or for an analysis of every aspect of trade down to its most insignificant local or curious detail, that so-called commercial geography cannot be an orderly study, nor can it be an integral part of a science of geography. If, on the contrary, commercial geography is defined as, and limited to, the study of the relationship between physical

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* Italics are mine.
† Chisholm. *Scot. Geog. Mag.*, 1908, p. 123.
‡ Eckert, *Scot. Geog. Mag.*, 1907, pp. 563-566.

conditions and the transportation and exchange of human utilities, it immediately becomes capable of orderly arrangement, it is an integral part of a science of geography, and its place in the logical grouping of the fields of that science is obviously next to economic geography. It may be considered either as a sub-head under that subject or with equal justice placed as a co-ordinate phase of the large field of anthropogeography, in deference to the importance of commerce to modern civilization.

According to the above definition the field of commercial geography is made distinct, and all items, however important from the commercial standpoint, but not entering into geographical relations, are excluded. Commercial geography seeks merely to study the commercial responses to conditions of the environment, and does not in any sense seek to describe or explain all existing or conceivable trade relations. Commerce and commercial geography are distinct and separate fields of study. Furthermore, commercial geography is not concerned with production beyond the fact that certain human utilities are brought into existence, and hence may enter into movements and exchanges which may be determined by conditions of the environment. Resources and productions are the *foundation,* but their consideration is not the *field,* of commercial geography.

Economic geography deals with the types of environment in which man may live; commercial geography deals with the relationships of special phases of human activity developed in certain of those types. The two plainly enough can be treated to advantage simultaneously, in so far as any particular type of environment is concerned, but the line of division between the two phases may equally well be drawn as sharply as between any other two phases of geography.

Historical and political geography: The remaining two existing fields of ontography, historical and political geography, are relatively much less extensively developed than are economic and commercial geography; in fact they have in many places been accorded barely any recognition. Historical geography, so far as it has been developed at all, has been done mainly by students interested primarily in history, and working without reference to any logical structure of geography in which their results were to be an integral part. Political geography has rarely been the subject of mature, systematic study, especially on this side of the Atlantic. The natural result of these conditions has been to leave the field of ontography in an unfinished and indefinite state, since, in certain respects, historical and political

geography are to be regarded as marking the culmination of the subject.

Criticism of historical geography: The objection has been raised that the designation, historical geography, is a misnomer, since "geography is not a historical study," and that this field might better be called "geographical history."* The former term, however, is in general use, and may be justified on the grounds that it is uniform in character with economic and commercial geography, and may be interpreted, as in the case of these latter, to imply simply relationships of a particular sort, here between environmental conditions and responses in the past. It is further criticised that the so-called historical geographies are "merely mechanical combinations of out-of-date editions of political geographies . . . bound together in one volume" and that "in order to systematize the study of historical geography a basic principle is necessary."† The first part of this contention finds its cause in the fact that historical geographies have been developed with reference to historical relations, which are avowedly chronological, and therefore unsystematic, and not with reference to geographical relations. The second part of the contention may be satisfied by introducing into the subject the basic principle of "the relation of the earth to life," which immediately sets the bounds of the subject and throws it into the orderly scheme of a geographical science.

Definition of historical geography: It is necessary to recognize, however, that the "historical" part of the term may be interpreted in different ways. It may be taken to mean the history of man in the progress of his civilization, or it may be taken to mean the political history of various human groups or nations. According to the adoption of the one meaning or the other, the subject has a different significance to geography as a whole. If the first interpretation is followed, it will result in a co-ordinated study of the relationships between man and his environments at different times in his progress, and thus furnish a connected, complete background for the interpretation of existing civilizations in their geographic relations. If the second interpretation is followed it will lead to the truly geographic explanation of many events in the past, such for example, as the strategic value, and defense, of the pass at Thermopylæ, of interest and help in the study of history, but of little or no significance to the present problem of the study of the relation of the earth to its inhabitants. From the standpoint of geography as a science, there-

* Davis. *Proc.* Amer. Phil. Soc., XLI, 1902, p. 241.

† Keasbey. *Pol. Sci. Quart.*, 1901, p. 89.

fore, historical geography may more profitably be interpreted in the sense that it is the study of the relations of the earth to the development of human civilizations. Defined briefly, historical geography may be considered as the application of economic geography in the past.

The development of the subject along these lines would necessarily involve the most important responses in the history of groups or nations, and would similarly subordinate the great mass of interesting or curious items, having little or no bearing on the understanding of the earth in its present relations to life.

Political geography: Unsatisfactory condition. Political geography stands as the one phase of the subject, so much neglected in the mature study, that few even have ventured a definition of its particular field. This state of affairs accounts perhaps for the criticism that the text-books of political geography, "are for the most part made up of variegated maps exhibiting the territorial extent of states, population statistics set forth in tabulated form, and running commentaries on the topography of the various countries considered."*

Concept of Political Geography: Among the few definitions which have been framed, however, unanimity of concept is conspicuously lacking. A definition typical of one group says "political geography may be defined in general terms to be geography in relation to political and social institutions."† The use of the word social in this definition makes the exact sphere vague, for the reason that many social institutions might be mentioned, under the broad interpretation of the term, which are so far remote from political institutions as to preclude coherence in any study attempting to cover both. This difficulty is not removed by the further elaboration of the concept where it is said that, in teaching the subject, emphasis is laid on (1) explaining how each country studied came to be a separate, distinct country; (2) on its political institutions, and the geographic influences that have affected them, and (3) present political problems of paramount interest in each of the countries studied.

Such a concept cannot be accepted as it stands, since, for example, explaining how each country came to be separate, leads in most cases far into the realm of pure history; the study of political institutions, as such, belongs to the student of comparative governments; and political problems of paramount interest, may it is true,

* Keasbey. *Loc. cit.*, p. 89.

† Johnson, E. R. *Bull.* Amer. Geog. Soc., 1906, p. 107.

but do not necessarily, enter into geographical relations; where they do not, the entire consideration of them is the task of the political scientist, not that of the geographer. In these respects, therefore, the concept includes too much, and in doing so leaves the true field of geography. In other respects, that is, when regarded from the standpoint of evolving an orderly science of geography, which shall be both logical and complete, this concept is too narrow.

Definition of political geography: Political geography should be interpreted not as the study of the geographical relations of political institutions, and problems, but more nearly in accordance with the concept as stated by Keltie, to the effect that "Political geography is the application of the data included in these two great divisions of the subject (physiography and anthropogeography) to the affairs of those groups or communities of men, which in their more developed condition we designate states or nations."* A simple adaptation of this concept may define the field of political geography as the study of the relations between political communities, or nations, and their surroundings.

Such a concept makes political geography dependent on all the other phases of anthropogeography, since economic, commercial and historical geography are necessary precursors to the complete understanding of the relations between national states and their surroundings. This concept also makes political geography essentially synonymous with one phase of regional geography, the regional unit being the political division in which the group is situated. Finally such a concept accords to political geography, the important function of bringing together the separate threads of anthropogeographic study into a definite whole, in which the goal attained is the interpretation of *modern* civilizations in their relations to the earth.

Political geography is consequently the logical capstone of the entire subject, and instead of deserving neglect, it is perhaps the most fruitful field of investigation now open to the geographer. Its successful development, however, hinges on the development of systematic geography as a whole, according to a single scientific concept or central idea. The comparative geography of different regions can not be treated satisfactorily until some system of geography has been adopted under which all investigators may work along harmonious lines.

The ontographic grouping: According to the various spheres assigned to the different phases of ontography by the preceding definitions and discussion, the existing phases stand in definite re-

* International Geography, p. 109.

lationships to one another and may therefore be grouped in the following progressive sequence. By applying the same principles other phases which might be developed could readily be placed in their proper association in the grouping as it stands:

GEOGRAPHY:
- Organic side—Ontography.
  1. Phytogeography.
  2. Zoögeography.
  3. Anthropogeography.
     - a. Economic geography.
     - b. Commercial geography.
     - c. Historical geography.
     - d. Political geography.

Such a grouping according to a single dominating, unifying principle, which is kept prominent at every turn—such a grouping, and only some such, can make geography an orderly study and make possible its reduction to a systematic science, not only in one part, but in every part, not merely in the general considerations, but in the regional studies as well.

Systematic Ontography: It is true that the ontographic aspects of geography are to-day studied in large measure individually instead of generically, but it is not necessarily so, for the reason that wherever similar controls operate on similar forms of life there are similar relations of responses of organism to environment. Thus it is possible under the relationship concept to have systematic economic geography, just as readily as to have systematic physiography, since the classification of environments is as practicable as is the classification of land forms or climates separately.

As soon as a classification for economic geography is adopted, the general principles of the subject may be elaborated, following which the development of regional economic geography—all on a systematic basis,—may be done as readily as regional physiography is studied systematically to-day. With the classification for economic geography completed, it serves as the logical basis from which to develop the other, dependent, phases of the subject, according to similar systematic treatment, a condition especially to be desired in the case of political geography.

Conclusions: One of the most serious criticisms of geography, to the effect that "scientific geographers stop short before the phenomena of civilization and take no account whatever of the recorded facts of history,"* could no longer have any foundation in case of a

* Keasbey. *Pol. Sci. Quart.*, 1901, p. 82.

scientific geography developed according to such a grouping as here presented. In this grouping there is a logical place for all the "phenomena of civilization" and the "recorded facts of history," in so far as they enter into true geographical relations. More than that is not the province of any plan of a scientific geography.

The question may also be raised as to the real position of the physiographer under this concept of geography. The position seems far clearer and more important than under any other concept, for, while physiography may be studied and considered by itself, geography, as here interpreted cannot be taught or studied successfully without physiography—the environment to which the life responses are made. Investigations in physiography alone, therefore, as serving to make clearer important aspects of life environments, are direct contributions to the subject of geography. The physiographer then is a geographer in the broad sense, and specifically a physiographic or physical geographer, in the same way as there are engineers in general, with civil, mechanical or electrical engineers in particular. This interpretation of geography consequently takes nothing from the importance of physiography—quite on the contrary it elevates that part of the subject to the plane of furnishing the foundation without which the rest of the subject can not be erected.

Finally, it has been well said in criticising adversely the concept here adopted for geography as a whole, that the "function of any science must be stated in such a manner as to afford a criterion of when its task is accomplished."* Such a statement of the function of geography as a science is possible only through the adoption of this principle of relationship by which the entire field is unified. That this concept makes it possible to mark the accomplished task is indicated in the establishment of an orderly system as is here suggested: a system of defining and grouping which builds up steadily and logically from control to response, from foundation to superstructure. In physiography its subdivisions are arranged in sequential order, culminating in the most important aspects of the physical environment—physiography of the lands and climates. In ontography, its divisions fall naturally into such a grouping that all lead up to and culminate in the most important aspects of the human responses—that is, in the geographical relations of human civilizations. Geography thereby is given the necessary qualities of a coherent science, with a perfectly distinct field not covered by any other existing science, and no longer is open to the criticism of being merely "a heterogeneous agglomeration of dissociated items."

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* Chisholm. *Scot. Geog. Mag.*, 1908, p. 568.

THE TERRITORY OF MAGELLAN

BY

MARRION WILCOX

Nearly one-fourth of the entire area of the Republic of Chile is embraced in the Territorio de Magallanes, which extends along the Pacific coast from lat. 47° S. to the southern extremity of South America. On the southeast it is, indeed, separated from the Atlantic Ocean by outlying portions of Argentina; nevertheless the most important eastern outlet is secured to it by Chilean control of both sides of the Straits of Magellan. It has thus practically an outlook upon both oceans. Moreover, in accounts of the early voyages to the New World as well as in the most recent reports of South American progress, this region figures prominently. An elaborate and authoritative statement in regard to its geography, history, industries, and population has long been desired; and such a statement has recently been published in Spanish at Punta Arenas.*

We learn that the surprising development that has taken place during the last decade in the Territory of Magallanes and the city of Punta Arenas, in population and building as well as in all branches of commerce and industry, in sheep and cattle raising and mining, prompted the city magistrates to enter into arrangements for the preparation of a general census of the Territory; and doubtless one of the motives influencing them is to be found in the fact that erroneous reports had gained credence, both at Punta Arenas and in South America generally, such as, for example, the report that a majority of the inhabitants of the Territory were foreigners.

In order to enhance the importance of the work and give it an official character the commission of Alcaldes requested the national government to lend its approval to the plans for taking this census, and the request was granted immediately. The governor of the Territory applied to the Central Office of Statistics for some instructions that would aid in bringing the projected work to a successful conclusion. That office replied by sending model forms, blanks, etc.,

*Censo Jeneral de Poblacion i Édification, Industria, Ganaderia i Mineria del Territorio de Magallanes, República de Chile, Levantado por Acuerdo de la Comision de Alcaldes el dia 8 de Setiembre de 1906. Pasado i Presente del Territorio de Magallanes. Por Lautaro Navarro Avaria, Médico de Ciudad, Director de la Oficina del Censo. Punta Arenas. First vol., 4to, lxvi and 382 pp., 1907; second vol., 4to, 563 pp., 1908. A map and many illustrations add to the value of the work.

which were to be used in the next general census of the republic. The national organizations which are entrusted with the duty of encouraging various industries also coöperated by furnishing details in regard to their method of gathering information. We may, then, speak of this census as the first to be taken in any part of the republic in conformity with formularies adopted for the census of the whole country, for which plans were being made at that time. But it is much more, as we shall see.

Dr. Lautaro Navarro Avaria, who was appointed director of the work, has given signal proof of ability and enthusiasm. Desiring that the Territory should be correctly described from all points of view, he did not confine the undertaking within the limits of the plan for the general census: rather, he added a second part in which we find full particulars regarding the local administrations, fiscal and municipal; meteorology, demography, nosography; commercial and maritime affairs; the progress of education and the philanthropic or social organizations. The director writes: "I think that the combination . . . makes a very exact picture, representing the grade of advancement attained by the Territory of Magallanes in its short life, which barely extends a bit beyond sixty years." He has not taken into account the nomadic, aboriginal population of the Chilean sections of Patagonia and Tierra del Fuego and the western canals of Patagonia and Beagle; but, on the other hand, this survey does include natives under the protection of Anglican and other missions. It appears that the Chilean people themselves require instructions in regard to this region which has been a terra incognita even to them ("tan desconocida hasta ahora"). The director of this census thinks that the degree of progress and culture to which this remote territory has attained will be a genuine revelation (verdadera revelacion) to citizens of Valparaiso and Santiago. The Territory has received a current of immigration much greater than that which has been available for the development of other portions of Chile; and a great majority of the immigrants have been men who came to take part in sheep-raising and the varied industries, or who were attracted by the discovery of gold.

The total area of the Territory is 171,438 square kilometers (66,861 square miles), the continental part comprising 86,972 and the islands 84,466 square kilometers, according to this authority. In order to bring out more clearly the meaning of these figures, the following areas are offered for comparison: Rumania has 130,000 square kilometres, Uruguay 178,700, Italy 296,000, and the Republic of Chile in all 756,990. The inhabitants number 13,309.

We find 80 per cent. of the population of the Territory concentrated in the city of Punta Arenas and the town (officially designated as a "city") of Porvenir; only one-fifth, or about twenty per cent. in those portions of the rural districts which are dedicated to stock-farming. The climatic conditions are unfavorable to agriculture in the wider sense of the term, but sheep thrive uncommonly well on the immense pastures. The number of shepherds employed decreases steadily as the holdings called estancias increase in size. Thus, to cite only one example, in the region of Ultima Esperanza before 1905, when there were many estancias owned by different people, the population was greater than it is at present, simply because all but two or three of the estancias have been acquired by a single company, the Sociedad Esplotadora de Tierra del Fuego. The rural population is very unevenly distributed, one-third of the total number living in a relatively small area north and south of Punta Arenas and between Cabo Negro and Agua Fresca.

A large majority of the houses are of wood, and a single story in height, the average number of occupants in each being 5.24. The increase in the population of the Territory since the year 1843, when the Chilean government "occupied" it by sending eleven colonists to Fort Búlnes, is traced as follows: The increase is most noticeable between 1885 and 1906. In 1889, Governor Samuel Valdivieso succeeded in attracting to Punta Arenas many families from the central and southern provinces of Chile, by granting to such new comers building sites within the city limits. About the same time the development of stock-farming and the discovery of gold drew immigrants from England, from Buenos Aires, and from Valparaiso. During Manuel Señoret's administration the government continued to offer substantial inducements to settlers. We note that 2,918 persons arrived between 1894 and 1899.

Of the total population, 62.13 per cent., or almost two-thirds, are males, although the equilibrium between the sexes is more nearly established in the Chilean element. Among the foreigners the difference is enormous, 72.41 per cent. being men and only 27.57 per cent. women. The assumption that the foreign element is numerically predominant proves to be wholly unfounded. The census shows that two-thirds of the inhabitants of the Territory are Chileans (exactly 64.06 per cent.) and only one-third, or 35.93 per cent., foreigners. The only part of the Territory in which the foreign element predominates is Tierra del Fuego. A surprising fact brought to light by Dr. Avaria's investigations is that Austro-Hungarians constitute 30.71 per cent. of all the foreigners. The English, form-

erly most numerous, now rank second. Then follow the Spanish, Italian, German, Argentine, and French groups. An analysis of the population with respect to religions shows representatives of the Roman and Greek churches; Protestants (nearly one-half of whom are Chileans); Jews and Mohammedans. The Christians predominate, and a great majority of them are Roman Catholics.

Exceedingly interesting are the statistics relating to instruction, for it is shown that 77.77 per cent. of all inhabitants of the Territory, above the age of six years, can read and write; 1.89 per cent. can read but cannot write; and only 20.33 per cent. are entirely unlettered. But the percentage of illiteracy in the Republic of Chile as a whole was given as 75 per cent. in the census of 1885 and 72 per cent. in the census of 1895! Comparing the Chilean population of Magellan Territory with the foreign element, the former shows 25.51 per cent. of illiteracy as against 13.23 per cent. for the latter. A still more favorable result is obtained if we scrutinize the reports of primary and secondary schools. It appears that more than 83 per cent. of all children of school age can read and write, while less than 17 per cent. must be classed provisionally among illiterates.

Only 14.35 per cent. of the inhabitants are land-owners. More than one-half of all real estate belongs to Chileans; 17.80 per cent. to Austro-Hungarians, and 4.55 per cent. to Spaniards. The city of Punta Arenas, with its suburbs, has 10,103 inhabitants. Porvenir is credited with only 519.

We are dealing here with a handful of people in a vast region, but we share the Director's opinion that he was fully justified in his efforts to enlarge the scope of the work assigned to him. He writes: "We decided to prepare a work which should be the first complete census ever made in Magallanes. As such it may serve as a basis of comparison for those which shall be subsequently undertaken. Moreover it was proper to make known the structure of the population of Magallanes in general, and of its two cities,—so different from that of the rest of the republic." Characteristic of the progressive spirit of this small and remote community is the circumstance that Punta Arenas was the first city of the Republic of Chile to establish a branch of "that altruistic and philanthropic institution, the Red Cross." We read that an organization founded in December, 1903, was officially recognized in 1905 as the "Instituto Central de Chile de la Cruz Roja Internacional."

Punta Arenas already has some of the features commonly associated in our minds with a much larger place: The civil and maritime government houses; the dockyards of the naval stations; hos-

pitals and a lazaretto; formidable prison and penitentiary, police headquarters, and court rooms; social clubs and municipal theatre; public library (sadly limited), English, German, and public schools; three daily newspapers and other periodicals. Its maritime traffic is very little inferior to that of Valparaiso, because its position on the Straits of Magellan makes it quite inevitably the port at which all trans-Atlantic steamers call, to renew provisions or effect repairs of their engines, or perhaps only to pass a few hours while awaiting a favorable moment for passing more or less dangerous points. In the course of a single year (1906) vessels entering the port numbered 969 (tonnage 1,193,556), including 68 warships, 795 merchantmen, and 106 sailing vessels; and vessels leaving the port numbered 979 (tonnage 1,197,347), including 71 warships, 800 merchantmen, and 108 sailing vessels; the grand totals for the year being 1948 vessels and 2,390,903 tons.

It is a pleasure to find in that part of the world a region for which the claim is not advanced that it excels all others in mineral wealth. The Territory of Magellan has no mineral resources that can be compared with those of the provinces of the north and center of the republic; such is the frank declaration made in the second volume. Exploitation of minerals, we are informed, is effective at only two points; and reference is made, first, to the veins of coal (more strictly speaking, lignite), not of the best quality, which for a number of years have been mined at the Loreto, near Punta Arenas, and, second, to the copper ores obtained at Cutter Cove on the peninsula of Brunswick. There remain to be mentioned, so far as our knowledge extends at the present time, only the washings of auriferous soils at some points in Tierra del Fuego and the Minas River; bitumen or asphaltum (of which there are indications, though no considerable deposit has been found); petroleum (doubtful); and calcareous and other salts. A very modest list; and we notice with satisfaction that the writer who contributed this chapter realizes the impossibility of obtaining exact information when mining enterprise is still in the initial period—the period of study and preparation.

Geographical and historical studies in the second volume are particularly interesting. Even such brief enumeration of topics as our limited space permits will convey some idea of the main divisions of the Territory. Thus, separate and distinct consideration appears to be required for the following: North Continental Section; Central Continental Section—Region of Ultima Esperanza; South Continental Section—Chilean Patagonia—Peninsula of Brunswick; Western Islands and Channels of Patagonia; Islands and Channels

north of the Strait of Magellan; Islands and channels south of the Strait of Magellan; Tierra del Fuego; Islands and Channels south and west of Tierra del Fuego. An acceptable offering of more or less new information is made in the pages devoted to lighthouses, ports, and roads; discovery of the straits and subsequent voyages; flora and fauna; and Chilean hydrographic explorations.

EFFECTIVE OCCUPATION OF UNDEVELOPED LANDS

BY

S. P. VERNER*.

We shall here consider the application of the scientific method to the "benevolent assimilation" of the still unconquered wilderness of new lands. Here are found a most bewildering array of heterogeneous problems, full of the most complex factors. There are barbarous peoples to be reduced to order, presenting psychological phenomena of the most intricate sort, questions in jurisprudence, in ethics, in political and social science, in military strategy, in governmental policy, each element a world of study in itself alone. Then there are questions in sanitation and hygiene—great heat, or abnormal variations in temperature, noxious insects, venomous or ravenous wild beasts, the stolid inertia of unbroken forest or of sterile desert, or of the rocky rampart of some impeding mountain chain. There are difficulties of navigation, seas and rivers to be charted, marked, and made safe, marshy plains to avoid, and many other questions, including that of profit and loss.

Men have blundered blindly in their contact with these problems, and so we have the sad story of early America, the awful history of most of Africa, the loss of great capital, the blasting of many fair hopes, the vanishing into thin air of many splendid schemes for the extension of civilization. But these things need no longer be. There is a method, capable of clear definition and of precise execution, which may be applied to promote the efficient

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* Mr. Verner, well known as economic pioneer and explorer in the Belgian Congo, kindly permits us to print these extracts from a paper not yet published. His long, practical experience gives much value to this suggestive paper.

conduct of the work of developing the still unassimilated regions of the world.

The cause of most of the initial misery in Africa, as well as in Central and most of South America, was that the early settlements were death-traps. The reason is not far to seek. The east and west coasts of Africa are bordered by a littoral, low, marshy, mosquito-breeding, with high temperature and great humidity, untempered by altitude, and wide enough to offer a considerable journey to those seeking the interior, sufficient for a long time, before the development of means of rapid transit, to confine settlement to the coasts. Eastern South America, which was the first to be explored, offered similar conditions. Hence the settlements were all more or less alike in their semblance to the part of West Africa, of which the doggerel ran:

> "Beware, beware, of the Bight of Benin,
> For one that comes out, there's ten that went in."

It is wise to discriminate clearly between the two distinct classes of general enterprise before us. These are colonization by the whites, and civilization for the blacks. Perhaps it may not at first appear that these two are mutually dependent, but they really are, and they react and interact in a way which makes the success of the one a prime factor in the progress of the other. The colonization of the whites, and the civilization of the blacks, may go on *pari passu,* in a relation of reciprocal helpfulness. It is to be observed that what will make real settlement and permanent occupation by the whites both comfortable and remunerative will also add to the happiness of the blacks, for it is just where the white man is most unhappy, least able to work, most dependent on black servants, and forced to a life of make-shifts, that the blacks suffer most. The scheme to be outlined is one which will do as much for the aboriginal inhabitants as for the incomers.

The ten main features of the method advocated are these:

First: Seek to find a port on the Coast which is nearest to any elevated region or mountain, if possible having an altitude of 9,000 feet or more under the equator, or less to the North or South by 300 feet per degree of latitude. Are there any such places? They will be found in the hinterland of Sierra Leone and Liberia, at about 100 miles from the Coast; at Cameroons, at ten miles from the sea; at Sona Ngongo on the Congo R.R., at 200 miles inland; at Bihe in Angola, at 300 miles; in Mashonaland at 400 miles; at Kilimanjaro in German Africa at 250 miles; and in the Abyssinian highlands at a much nearer distance. In South American countries

such places are too numerous to mention on the West Coast, and they are happily not infrequent on the East.

The most specific effort must be made to aim at reaching any one of these highlands as early as possible; settlement on the coasts or below the safety-line should be entirely restricted to the barest requirements for reaching those uplands; farther progress inland should wait for the completion of a well-rounded colonial establishment on a suitable place in this desirable region; and the speediest possible means of transit should be inaugurated to it. In other words, this region should be the base, and it should be as well developed as Gibraltar, a sort of industrial fortress to command further operations. Let us call this base the High Colony.

Until the High Colony can be reached, a preliminary base must be established on the coast at the port. This unfortunate geographical necessity should be treated with great care in the selection of the locus. It is right here that many errors have been committed. A river's mouth is very tempting for such a base, and generally a worse place could hardly be found. At the mouths of every one of the African and South American rivers there has grown up a pest-hole. It will be found that, generally, there is a sort of high peninsula abutting on or projecting sometimes far out to sea where a watershed runs down to the ocean between two rivers. This is notably the case with Cameroons mountain, which marks the ocean terminus of the watershed between the Calabar and Sennaga rivers. There are plenty of other such watershed termini all along the tropical coasts, mostly neglected as possible bases, because mariners have aimed at the estuaries, while really these promontories often form ramparts for the best harbors. The promontories are also, usually, the nearest natural seaports for the highlands from which they extend. There is one splendid example of the application of this principle, where the French government has built a city at Dakar, below the mouth of the Senegal, and practically on exactly such an ideal watershed-terminus as that described. Dakar is the finest, healthiest and most successful port in West Africa, and is a shining example of the application of this idea.

Second: Build a preliminary rapid transit line from the port to the High Colony. Here a prime difficulty arises. How are the evils of the coast region to be avoided while this line is being projected into the interior? The reply, of course, is that the evils cannot be entirely eliminated. But, in the conditions of modern constructive methods they may be greatly minimized, and since this one line is to do duty for a vast area, to remove wholly and forever nearly all the

evils previously endured, it is evidently a case where some suffering is justified for the great end to be achieved. Then too, this method concentrates all the necessary preliminary troubles into the building of this one line, whereas the previous haphazard settlement of the whole coast and the inconsiderate pushing inward all along the littoral has vastly increased the area of unhappy existence.

Then, too, if one chooses for a port the watershed terminus above described, he has only the valleys or marshy banks of the short streams which may occur at such places to deal with, so that in ten or fifteen miles he may reach a territory entirely free from mosquitoes and the water-loving insects (among which is the worst of African pests, the tsetse). White men may walk this distance, put their tentative camp there, install as a first work a pumping arrangement to get their water up above the mosquito-limit, go down daily to any necessary work on the beach, and return to spend the night at their high camp, by means of a preliminary road and traction vehicles. These two means of beginning work—pump and automobile—ought to be the first things considered in the new method.

This port ought to be developed for the one main purpose of being a base for this rapid transit line, and that alone, until it becomes, by sanitary engineering, entirely free from objectionable features. These sanitary measures are now so well known, thanks to Dr. Gorgas and the lessons in Havana and Panama, that they need not be described here.

Third: Concentrate in the first High Colony all the requisites for the further effective occupation of the remoter interior. This is of far-reaching and fundamental importance. What are these requisites?

The first one, and that of preponderating importance, is fresh food, sufficient in quantity and variety as well as in quality, for all the needs of the colony. It is here that the most woful mistakes have been made. Immigrants into Liberia have almost starved to death in one of the richest agricultural regions in the world. This I saw with my own eyes. In the early days of the Congo the sufferings of the whites from canned goods, and of the native laborers because of the early exhaustion of the surrounding regions during the building of the railroad and the inadequacy of the imported supplies, as well as the high cost of the latter, were a feature of the history of that country which it is to be hoped no nation will ever allow again. Indeed, the same thing is even now going on wherever concentration of labor is greater than local food-supply. This almost stopped the Benguela railway, and has been the *bête-noire* of all new

enterprises. While the first rapid transit line is being built, a field of a size proportioned to the number of men to be employed, and of the prospective number of coming colonists, ought to be cleared off, utilizing for the purpose all the most modern labor-saving machinery.

This work should be done with machine saws, stump-pullers, chain-drags operated by steam, steam-plows, large disc turn-plows, cultivators, etc. In fact, there is nothing which America has invented to facilitate farm clearing and cultivation which ought not to be used on such a place from the start. The mule did wonders for the plantation darkey, and the traction engine will do more for his African cousin. He must keep the fires going or the machine will not go. Put him at feeding logs to a saw, and he becomes an industrious laborer in a few weeks, where, as a wood-chopper, he may be a shirker for years.

Let us be specific as to this question of food. Suppose provision must be made for ten thousand laborers. This cannot be gotten in the region round about, for the native agriculturists raise barely enough for their daily breakfast, and their little hoes and axes are inadequate for more. To import enough would cost, on the Central West African Coast, in two years, at least $1,000,000. Now, a tithe of this expense would supply machinery, and completely clear off and cultivate a field large enough to feed all these men, besides leaving the field as a permanent asset to the colony. Three thousand acres of land planted in corn, peas, bananas, and garden truck, would be enough, while the forage would raise cattle, goats, and fowls in abundance. A fishery should be carried on at the port. In fact, if this method be taken at its full significance, it can be made the means of so ministering to the success of the enterprise as to make the difference between success and failure. Moreover, this planting must be done early, in anticipation of developments. No one need ever hesitate over possible loss in this matter. Such a food-center would attract natives for hundreds of miles around. Once gaining their good-will and making them look to the newcomers for a steady and abundant food-supply, and their labor can be used for the more remunerative business, such as rubber, mining, coffee and cacao growing and whatever local conditions may indicate. How much more desirable a system this is than that by which the early pioneers alienated and largely destroyed the American aborigines, and caused the infamies of the slave-trade days in West and East Africa! I know this, for I have tried the system, and it was so successful that it almost threatened to ruin neighboring enterprises by drawing all their labor away.

The second requisite is sanitary engineering. Before a town cumbers the ground, let every village be laid off with reference to the disposal of sewage, the purity of water-supply, the elimination of pests, the securing, if possible, of natural drainage, the clearing of all insect-harboring bush and grass, the retention of proper but not superfluous shade, the avoiding of bad winds and fogs, the provision of wide streets, the separation of different classes of population and of business and residence, the building of quarantine and hospital facilities, and the regular inspection both of premises and of the persons of the population. The latter may be an innovation, but it is a justifiable one. Let us build, if anything, better in new lands than at home. It would be a good thing if every person in such a colony were periodically examined by a physician, as well as his premises, to the end that disease be minimized.

Another requisite is the right kind of house for the local conditions. It is now known that the heat of the tropics does little damage if there be adequate protection between the head and the sun. If necessary, the houses may be specially protected against noxious insects.

A large retail magazine ought to be provided with every class of goods likely to be needed by the white settlers or the natives. The sale of intoxicants should be strictly limited and subject to regulations promotive of temperance and sobriety. The Belgians in the Congo issue permits for a limited quantity of spirits weekly, and no one is allowed to buy more. This may look like sumptuary legislation, but the principle worked out well in practice. A thoroughly organized medical service is a necessity, with a complete system of hospitals, quarantine stations, dispensaries, and free clinics for the indigent natives.

Provision for the recreation of the colonists ought to be made. Here there is often a lamentable lack of proper attention. Europeans are so wedded to the musical café, that they feel lost if they have no such place to which to resort after work, and the lack of it often drives them to excessive drink or other degradation. It is a common mistake to imagine that out-door exercise is unwise in the tropics. The most efficient official I ever knew in Africa, one who has held his post for twenty years in a very trying position, has probably played 10,000 tennis games in that time. Of course such recreations as shooting and fishing, botanizing and zoölogical collecting, photography, and the like are always open and ought to be highly encouraged.

Schools for the youth, and at least a sort of club or gymnasium

for all, ought to be included in the scheme, with plenty of books and an abundance of current literature.

The religious side of the life ought to be left to private initiative, but missions should be allowed to establish themselves, and to have full opportunity to do their work, although they should not be allowed to trade or to engage in industry in competition with other business.

Fourth: The safety-limit between the High Colony and the lower country having been found, let those who may be obliged to work below that limit go down to their work and return to the uplands daily. This necessitates an extremely efficient transport service. Indeed an ideal morning and evening train might well be run at high speed, for this purpose, and at low rates. This may be costly, but it is not so expensive as failure. There is really no need of any considerable establishments in the lower regions at all. A proper railway organization ought to receive cargo and carry it away as fast as unloaded, requiring only a large wharf-shed, and the minimum office arrangements, with a restaurant and toilet rooms. The country about the port ought to be cleared and drained, for the sake of the ships and the day-workmen, but if I had the power of *ukase* on the subject, I would not allow a single trading establishment, residence, store, factory or anything of the kind below the safety-line.

The natives, too, should not be allowed to stay in these regions at night. It is a common fallacy to think that the natives are immune to malaria, and to other of the ills incident to such localities. They are not only subject to all of them, but they are often decimated by them, and they convey these diseases to the whites. When one reflects that with the fast train and the telephone, as well as the automobile, one may fully work up a region of a diameter of over 100 miles from its highest and healthiest center, with all the residences and miscellaneous business establishments about this center, it is seen that not many such centers are required to effect the complete assimilation of an immense area. A hundred such centers, for example, would dominate the whole Congo basin, and eliminate most of the ills under which such a region suffers, under the old régime. In fact, by this plan, there need be no malaria, sleeping-sickness, dysentery, and other such diseases.

Fifth: The next principle is the extension of the rapid-transit lines into the surrounding territory from the first High Colony as a base, in directions indicated by natural resources. Any trunk-line, however, in general, ought to follow the watershed between large rivers, or at least be built above the safety-line.

Sixth: Automobile or traction-roads ought to supplement the main arteries of railway or trolley lines. This watershed or upland railway idea offers admirable facilities for the electrification of the lines almost from the start.

Seventh: A proper oversight of forest-clearing ought to be maintained, so as to conserve rainfall and to prevent wasteful erosion. No clearings ought to be allowed at all except under permits specifically providing for this feature. In grass-lands along sloping-river valleys, the native growth ought to be retained in places calculated to effect this purpose, and trees ought to be planted under governmental bonus to aid the end desired.

Eighth: In utilizing the river-systems, the base of operations ought also to be the nearest High Colony. Having effected the establishment of this colony from the sea as above described, when it is desired to use an adjacent river for transportation, a spur-line can be built down to the river, the clearing and sanitary work may be done by coming and going daily, and the river-base made thoroughly safe before beginning operations from it.

Ninth: These river-stations can then be increased in number by the same method of going to and fro from the first base until the second is properly fitted for work. Steamers need then stop at night only at these properly arranged river-ports, and need no longer be what they have so long been—travelling pest-houses. It is to be said also that the watershed railway will make it generally possible to reach the river in an hour's ride by rail, so that the two may mutually assist each other.

Tenth: As a rule, it is desirable to develop a riverine country from the headwaters downward. This may seem paradoxical, and contrary to nature, but it is true. The Amazon Valley is to be conquered from the Andes side. The East Coast Railways in Central Africa will ultimately effect the fullest development of the Congo and the Nile, by using the fact that it is easier to ship down-stream than up, and if the short distance from the sea to the heads of most rivers in the yet undeveloped parts of the world be first crossed by rail, the rest is easy.

There ought always to be reserved in any governmental scheme a distinct place for the individual colonist, on lands reserved for the purpose and administered with absolute impartiality. The French Congo has an admirable arrangement of this kind, by which the writer was able to buy twenty acres, where he could not get one in the Belgian Congo. It was indeed easier for the writer to get 400,000 square miles as a concession for his American associates than one

acre for himself in fee. Needless to say, the French side of the Congo is more popular than the Belgian, though it is not intended to criticize the many excellencies of the Belgian system in other respects.

It is the duty of the government to inaugurate such a plan as that outlined above for the benefit of the individual colonist. It is the duty of the government primarily to select the sea-port, to build the transit line, and to inaugurate the High Colony. When this is done, and the colonist is thoroughly inoculated with the spirit of the method in question, the rest of the development is comparatively easy.

As to the fact of the great capital expense involved in this plan at the outset, as compared with the prevalent method of creeping up pestilential rivers, and making such temporary gains as are possible from point to point, it is to be said that the latter system costs more than the former in a few years. Let me cite a case.

The greatest of the Congo concessionaire companies is the Compagnie du Kasai. Its objective has been to get rubber from the rich uplands of the Kwango-Kasai country, in the south-western part of the Congo basin. In brief, by the system of creeping up the rivers, this company is now earning $2,000,000 net, per annum. Its steamer service has cost in all about $1,500,000. The loss from men who have died or been invalided home represents at least $1,000,000 during its history. The annual expense of sending men home at short intervals, as a result of their living on the river-sides, represents the capital, at five per cent., when totalled over the ten years of the life of the company, of $10,000,000. Here is a total expense of over $12,000,000.

Now let us take this $12,000,000 and apply it under the scheme outlined above. On the West Coast of Africa there is a good harbor—as West African harbors go—at Kinsembo, where the watershed of the Loge-Mbrie rivers runs down to the Atlantic. Back of Kinsembo is Bembe, on an upland about 3,000 feet high. A line from Kinsembo to Bembe would be in the direct line for the upper Kwango-Kasai. Such a line would traverse one of the richest rubber regions in Africa nearly all the way. From Kinsembo to Bembe is about 150 miles. Fifty miles further is the Kwango-Congo watershed, running northward for 500 miles. To get to the High Colony on this watershed from the coast, a railway would cost about $5,000,000. Another $5,000,000 would get to the Kwango-Kwilu watershed, and cross the Kwango, affording transport on that river downstream for the heavy imported goods, and also downstream to the Congo and the Congo railway for exports of products beyond the reach of the Kinsembo line.

That is to say, with the money lost in the present system, the plan for the effective occupation of the upper Kwango-Kasai on the lines of health and comfort could be readily carried out. Besides this, there would be permanent colonies possible in these uplands, lands could be sold at a good profit, agricultural products raised and shipped, and the whole region brought under the definite régime of genuine colonial enterprise.

A noteworthy illustration of the method here advocated is afforded in the case of the French possessions in the upper Niger. As the English held the lower river, the French were obliged to get into their upper Niger territory by just such a plan as herein outlined, from the West Coast at Dakar. While all of the principles laid down above were not fully embraced in the French scheme, still the French Nigerian colony bids fair to be a standing object lesson in colonial development as a result of the government having been forced to adopt this method more or less completely. One now goes from Paris to Timbuktu all the way by steam, and in greater comfort and speed than would ever have been possible by ascending the Niger.

NOTES ON THE DESCRIPTION OF LAND FORMS.—II.*

Le Relief du Limousin. By A. Demangeon. (*Ann. de Géogr.*, xix, 1910, 120-149.) There are some geographical articles which leave their readers with a confused sense of being lost in a maze of vaguely conceived hills and valleys, mountains and plains, where item follows item without plan or correlation. There are other articles from which the reader derives a clear picture of definitely conceived forms, grouped in an easily comprehended arrangement. The essay here cited on the Relief of the Limousin, a district in the northwestern part of the central plateau of France, by the professor of geography in the University of Lille, is an exceptionally fine example of an article that gives its readers a clear picture of the landscape that it describes.

The Limousin district, consisting for the most part of disordered crystalline rocks, overlapped on the north and west by gently inclined stratified formations, is over much of its area an uplifted peneplain, standing at altitudes increasing southeastward from 300 to 500 meters; but it is surmounted by scattered or grouped remnants of a still higher peneplain (800-900 meters) of earlier origin, and it is imperfectly dissected by young or mature valleys of later origin. Three cycles of erosion are thus recognized: Traces of the first are still preserved in

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the solitudes of the broadly rolling highlands, chiefly on the most resistant rocks, whence the rivers Cher, Creuze, Vienne and Dordogne radiate. The work of the second cycle has over the greater area destroyed the highlands of the first cycle, in producing the wide-spread peneplain of the uplands, the even surface of which traverses various rock structures indifferently; but the peneplain is often surmounted by unconsumed cones, domes and ridges; and where the higher reliefs are grouped in the still preserved highlands of the first cycle, the work of the second is seen only in broad valley heads that appear as open embayments in the highland border. The work of the third cycle begins where the streams of which the headwaters flow in broad and shallow valleys on the peneplain, or in the valley-head embayments, and entrench themselves in narrow, young gorges, which rapidly deepen beneath the upland valley floors, and become well graded and maturely open valleys of the third cycle on reaching the stratified rocks, if not sooner. Thus it appears that the general land surface in the first cycle reached old age even on the hardest rocks; that in the second cycle it reached old age over large areas on crystalline and stratified rocks alike, but that it reached only late maturity at certain points where highland residuals remain; and that the third cycle is still generally young, although the valleys far down stream have reached maturity, and some of the weaker stratified formations are already maturely dissected.

Whenever the description of a district can be reduced to a definite scheme of this sort, any local part of the district, such as a hill, an upland, a slope or a valley, can be quickly apprehended, as well for itself as in its relation to neighboring parts. The reader's imagination is thus easily lead to follow the writer's understanding of the observed facts. When an outline map and a series of excellent photographs are appended, as in this account of the Limousin, there is little left for the reader to desire, except to see for himself the district, with whose interesting features he already feels familiar.

The author of this article follows the inductive method of presentation. He opens his exposition by citing examples of empirically described forms, located with reference to small villages and streams, the names of which, probably unfamiliar even to many French readers, may be found on the large-scale maps to which reference is made in foot notes. For example: "If one advances from Bellac on the Vincou toward the village of Blond on the south, the valley of the Vincou is crossed at an altitude of 180 m.; then on ascending the left slope of this valley, one reaches at about 285 m. a plateau which continues for several kilometers at about 290 or 300 m.; the plateau is a platform of crystalline schists faintly undulating with gentle depressions, covered with fields and woods. At last, suddenly, in the neighborhood of Blond, massive highlands rise in rounded forms to altitudes exceeding 500 m." In association with several similar accounts, a little later one reads: "We have, here as well as there, the same two topographical elements; first massive highlands, and next a platform on which

the highlands rest. In this platform the present valleys are excavated." After three pages of these empirical details, a page is given to a general account of the highlands, and three pages to the platforms or plateaus; and only on the ninth and tenth pages of the article, after the reader has inevitably discovered for himself that he has to do with a district of three cycles of erosion, is the explanatory scheme of the three cycles explicitly set forth.

Is it not worth considering whether the explanatory scheme should not be placed, for the convenience of the reader, on the first page of an article of this kind? The scheme offers no particular difficulty to the understanding; it is not a venturesome proposition which needs a gradual introduction in order to persuade the reader to accept it; it is simply a new example of an explanatory or genetic conception of land forms that must now be familiar to every modern physiographer. True, in the course of his investigation, the observer must accumulate his items of fact, one by one, as his field studies advance; only after such a beginning can he reach an inductive generalization. He may perhaps at the outset not at once understand what he sees, and in such a case his earlier notes must necessarily be in empirical terms. It may be only near the end of his records that a well conceived and concisely phrased scheme embracing all his results is elaborated; though in a district where the relation of forms is so manifest as would seem to be the case in the one here treated, a growing suspicion as to its evolution might have been written down along with the notes of the walk described in the introductory paragraph, quoted above; and a strong persuasion or even a conviction of the truth of the suspicion might have been noted with the records of the second or third experience of this kind. But when it comes to presenting the results of the investigation, is not the convenience of the reader greatly served by reversing this order, and concisely announcing the conclusion at the outset; so that, as the reader afterwards comes upon the separate items of fact, he may at once place each one where it belongs, instead of having to carry it in uncertain position in his memory until the conclusion, unnecessarily delayed, is at last disclosed? Experiment in this direction is worth making.

Schleswig-Holstein. By K. Olbricht. (*Geogr. Zeitschr.*, xv, 1909, 315-332.) If there are still some geographers who are uncertain as to the relative value of the explanatory as compared with the empirical method of describing land forms, here is a second article which should lead them far towards a decision in favor of the former and more rational method. Its readers learn that the peninsula which includes Jutland (the mainland part of Denmark) on the north and Schleswig-Holstein on the south, is made up of a series of subparallel elements, arranged in meridional belts, the axial member being a young terminal moraine. On the east the moraine is adjoined by a rolling drift surface of uneven hills and hollows, often holding lakes in the south and repeatedly traversed by shallow west-east troughs. On the other side of the moraine is

a west-sloping moorland of outwashed sand, spread forward on a gently undulating surface of older drift, through which some isolated masses of still older drift rise here and there, especially in the south; and on the west border of which the waves and the winds, sweeping in from the whole breadth of the North sea, have submaturely retrograded the originally irregular shore line and thrown up a belt of dunes next inland from the gently sloping beach. The west-east channels east of the moraine are explained as valleys, normally eroded in layers of gravel and till, and enlarged by the last advance of the ice, which furthermore scoured and roughened the neighboring partly dissected drift surface of an earlier advance, sometimes producing drumlins; it was this advance of the ice that formed at its western border the terminal moraine which now constitutes the axis of the peninsula. Some of the streams of the western slope rise a little east of the moraine and make their way through it in notches.

The northern part of the peninsula, or Jutland, still retains a good part of its original breadth, although the enclosed bays between the truncated headlands of its west coast, as well as the islands on the east coast, suggest some diminution by moderate submergence before or during the development of the present shoreline. The southern part, or Schleswig-Holstein, has been reduced to half the breadth of Jutland by greater submergence. Thus a good part of its former eastern extension has been cut off in scattered islands, its present eastern shoreline has become extremely irregular, and the channels in the eastern belt of rolling drift are now occupied by slender arms of the sea, or Föhrden, which reach nearly or quite to the axial moraine; while on the west the outer part of the older undulating drift surface is drowned, and the dunes that formerly rose on it in a presumably continuous line, such as still exists along the west coast of Jutland, are broken and worn back in discontinuous islands, which very imperfectly enclose an area of high-tide marsh and low-tide mud flats. With the exception of the vigorous attack of the sea on the west coast, post-glacial erosive processes have had little effect; nearly all the surface still remains about as it was left when the last ice sheet vanished.

The meaning of the contrasts in breadth and outline of the southern and northern parts of the peninsula is thus made clear and easily remembered. Each element of existing form is presented as the product of sufficiently defined general processes; and the relation of the several meridional belts to each other, both in their original breadth and in their present unequally diminished breadth, is easily understood. On a rational basis of this kind, local details and place names are easily added. For example, the broken dune-islands of Schleswig are known as Fanö (this one belonging politically in Jutland), Römö, Sylt, Amerum, and so on, and constitute as a group the North Frisian islands: the southeasternmost member of the series is still attached to the mainland by a strip of marsh. Tondem, Husum, Itzehoe and other towns on the west, south

as far as Hamburg, lie on tidal streams where the dry moorland meets the wet marshes; Hamburg gains importance over its less known neighbors, because of being situated on the Elbe, whose valley brings it into relation with much of North Germany. Hadersleben, Apenrade, Flensburg, Schleswig, Kiel and Lübeck are all at or near Föhrden-heads, east of the axial moraine.

The author announces his intention at the outset of giving a general view of geographical relations. In view of this object, he makes what the present reviewer is disposed to regard as a mistake in introducing a variety of geological details, for which no particular geographical application is found—a mistake for which much countenance may be found in many geographical essays of recent years, especially in Germany. A number of statements are of purely geological import, such as the thickness, deformation and erosion of the underlying Cretaceous and Tertiary formations; and these statements are moreover frankly recognized as largely hypothetical, because they are based more on the results of scattered borings than on surface observations, outcrops being very scanty. Similarly, certain accounts of the earlier glacial deposits are chiefly geological rather than geographical, because they are largely concerned with the order of past occurrences, as indicated by the succession of buried drift sheets; and because, with the small exception of the isolated hills of older drift mentioned above, these past occurrences do not bear directly on the features of the present landscape.

The reason for the introduction of irrelevant geological matters in a geographical essay of this kind is perhaps to be found in the extraordinary abundance, value, and detail of geological studies in Germany, and indeed in Europe generally. A geographer has almost to go out of his way to avoid being entangled in them, for they abound in geographical as well as in geological journals. In geology, all such details are of course essential; but if they do not bear helpfully on an appreciation of the visible landscape, or on the conditions and activities of its occupants, they are distracting interruptions in an avowedly geographical essay, where their space can better be given to matter of a more strictly geographical nature.

A notable novelty in Albricht's article is the use of the words *vergraden* and *Vergradung,* apparently corresponding to the English words, grade and grading: a welcome novelty indeed, for hitherto, the German equivalent of a graded river has been *ein ausgeglichener Fluss;* now it might be *ein vergradener Fluss.* If *vergraden* is accepted, it would seem as if *aufgraden, abgraden, vorgraden zurückgraden,* and *wiedergraden* might also be used as equivalents of the useful terms, aggrade, degrade, prograde, retrograde and regrade, particularly as it is difficult to form these compound verbs, if the already compounded verb *ausgleichen,* as the translation of the English verb, to grade, is taken as their root.

W. M. Davis.

GEOGRAPHICAL RECORD

AMERICA

PROTECTION OF THE GRAND CANYON OF THE COLORADO. This canyon in Arizona is now acknowledged to be one of the most astonishing sights of the world, and the greatest example of direct erosion to be found. The region including this enormous gorge constitutes what has been termed the "Geologist's Paradise," for the book of the earth's crust here opens to him its varied pages in a most extraordinary way. Bare edges of strata of thousands of feet are exposed for hundreds of miles; giant faults show themselves in numerous places; and all manner of geologic marvels are revealed. Of no less interest is it to the geographer, the botanist, the artist, the tourist, to everyone.

Realizing this, action from time to time has been taken by the government to protect and preserve the canyon for all the people. But probably through a misunderstanding of its magnitude up to the present, only a portion has been protected. This fact led the American Scenic and Historic Preservation Society recently to name a committee, consisting of Dr. George F. Kunz, President of the Society, Mr. W. B. Howland, Dr. Edward Hagaman Hall, and Mr. F. S. Dellenbaugh, who was one of Major Powell's companions in the exploration of the country, to take up the matter and to urge the extension of the reservation. By appointment, this committee called on President Taft on November 3 to lay before him the facts in the case.

The committee asked the President to withdraw enough of the public domain to include the whole of the chasm, from the head of Marble division to the Grand Wash, the end of the Grand Canyon division. He expressed himself as being entirely in sympathy with the project, saying also that the region ought to be a national park, that the creation of such a park is mainly now a question of method, and that he would bring it to the attention of Congress at an early date.

The lands to be withdrawn being extremely arid and rocky, with no settlements, and lying wholly within the Territory of Arizona, the question is not a difficult one. The magnitude of the canyon thus to be preserved is such that the Yosemite, the Yellowstone Canyon, Niagara Falls, Mt. Washington, and several other scenic treasures, all at one time could be scattered along its length and lost within it, for including the Marble Canyon division the continuous chasm, as the river runs, is 283 miles long, with a depth for many miles of from 5,000 to 6,000 feet and a width at the top of from less than one, to twelve or fifteen miles. The average depth is about 4,000 feet. The fall of the Colorado river in this distance is more than 2,300 feet, over a series of powerful rapids. Every tributary enters the main gorge through one of its own, hardly less majestic, and the proposed National Park would include a large part of some of these great side canyons.

THE HUDSON BAY RAILROAD. It is understood that the actual construction of the Hudson Bay railroad will begin next spring. *Canada* says that the contract for the construction of a bridge over the Saskatchewan River at the Pas Mission, about 52° 40′ N. Lat., has been awarded. The railroad has now reached this point and at the north end of the bridge, the building of the western

end of the Hudson Bay R.R. will begin. It is about 90 miles west of the north end of Lake Winnipeg and nearly as far north. The railroad will extend from the Pas Mission to Port Nelson or Port Churchill, from 400 to 500 miles.

ALASKAN EARTHQUAKES OF 1899. In 1905 Tarr and Martin investigated the striking evidence of changes in the coast line of Yakutat Bay during the earthquakes of September, 1899. During the preparation of their full report upon this evidence, the junior author, Prof. Martin, sought information concerning the area affected by the earthquake and its associated phenomena in regions beyond the area of field work. In a recent article (*Bull.* Geological Society of America, vol. 21, 1910, pp. 339-406), Prof. Martin has presented an outline of the results of this investigation. He finds that the greatest of the earthquakes, that of Sept. 10, was felt by observers in all places within a radius of 250 miles of Yakutat Bay, and at isolated points even at a distance of 480 miles. About 216,300 square miles of land were affected by shocks sensible to casual observers; and if it may be assumed that an equal area of the Pacific to the west of Yakutat Bay was also affected, the minimum area of disturbance was 432,500 square miles. A possible maximum shaken area of 1,539,000 square miles would be deduced if the radius were extended out to the regions where isolated observers have reported the shock. The earthquake, therefore, ranks high among the notable earthquake shocks of North America. For example, the California earthquake of 1909 was felt throughout an area of only 372,700 square miles. No life was lost, however, in this unsettled region, and no notable damage was done to buildings. Besides the interesting and important discussions of details concerning this earthquake and a study of seismographic records from stations all over the earth, Prof. Martin gives a list of the known earthquake shocks of Alaska as far as he has been able to obtain it. This list will be of importance in future studies of Alaskan earthquake phenomenon, and the article itself is a distinct contribution to the subject. R. S. T.

THE PAN-AMERICAN R.R. The British Minister at Buenos Aires reports (*Bd. of Trade Journ.,* Oct. 20, 1910) that the Pan-American Conference there resolved that the construction of the Pan-American R.R. should be left in the hands of the Pan-American R.R. Committee at Washington, which is advised to prepare a definite plan so that the line may be completed at the earliest possible date. The total length of the line from New York to Buenos Aires will, it is estimated, be 10,116 miles. The northern part of the line is now in operation from New York, through the City of Mexico to the northern frontier of Guatemala, 3,869 miles. The completed links in the line farther south, reduce the mileage still to be constructed to 3,700.

AFRICA

LIBERIA CONNECTED WITH THE GERMAN CABLE SYSTEM. On March 21, the extension of the Emden-Teneriffe cable was landed at Monrovia, the capital of Liberia. This is Germany's first cable connection with Africa. It is expected that the cable will be extended farther south to the German colonies of Togo and Cameroons.

PROGRESS IN SOUTHERN RHODESIA. A paper in *United Empire* (vol. I, No. 10, Oct., 1910) informs us that the Liebig Company is buying a ranch of 400,000 acres, to be stocked within five years, with cattle from which Liebig products

will be prepared. This seems to show that experts have concluded that stock-raising is now a safe enterprise in Rhodesia, although the pastoral industry has been retarded by the various cattle diseases which afflicted South Africa for years. The agricultural possibilities also are large and much is expected from tobacco and maize. It is not a country for the man without means, as a certain amount of capital is essential for successful farming. Rhodesia is now contributing a good deal of gold, the product amounting to $13,750,000 in 1909. The ore is of a quality that yields the best result from economical and individual working. Of the 145,000 square miles of Southern Rhodesia, three-fourths has an elevation of 3,000 feet and one-fourth, 4,000 feet above sea-level, so that the excellent climate makes the land a white man's country.

PYGMIES IN THE SOUTHERN PART OF THE KASAI BASIN. Mr. E. Torday, the Hungarian explorer, gave, on March 7, before the Royal Geographical Society, an account of the admirable work he has done in ethnology in the Kasai Basin (*Geogr. Journ.*, vol. 36, No. 1, 1910). He found that each chief in a large region south of the Sankuru River had under his suzerainty a small group of pygmies who hunt for him while he provides them with vegetable food in exchange for their game. One group, abandoning the nomadic life, has constructed a small village and taken to agriculture. This is, perhaps, the first instance of the kind on record. Mr. Torday makes this rather startling statement:

"Only two generations have passed since they left the forest, and they have already lost their pygmy appearance. Though not as big as the Bushongo, they have attained a stature far superior to that of the average pygmy. As intermarriage between Bushongo and these 'half ghosts' (which they are considered to be) is out of the question, it must be admitted that sunshine, air and regular life have been the main factors in this change." He also points out, what seems to be a parallel phenomenon, that, as a rule, the forest people are somewhat short in stature, but those who live in the open, cultivated clearings in the forest increase in stature.

THE LOWER CONGO R.R. Mr. H. G. Mackie, British Consul at Boma, reports that an electrical engineer has arrived there in connection with the proposed electrification of the railroad between Matadi and Leopoldville (140 miles) by utilizing the hydraulic power of the Congo cataracts which the railroad circumvents. The traffic on this line is steadily increasing, the most notable feature being the transport of large quantities of material for the upper Congo railroads, now under construction, as well as for the projected line in French Equatorial Africa (formerly The French Congo). All vessels arriving at Boma are heavily laden and several extra steamers are now in the service.

SECOND AFRICAN EXPEDITION OF PRINCE ADOLF FRIEDRICH OF MECKLENBURG. This expedition started for Africa from Hamburg on July 9. Its purpose (*Geogr. Zeitsch.*, vol. 16, No. 9, 1910), is to explore the boundary regions between the Cameroons and French Equatorial Africa (formerly the French Congo), and especially the very large and partly unknown areas of the numerous tributaries that join the Congo on its right bank. A visit to Lake Chad is also planned. Lieut. von Wiese, under the Prince, will lead the expedition, and the scientific members are Prof. Dr. Haberer, Dr. Schulze, Dr. Schubotz and Dr. Mildbrand. Mr. Heims is the artist. Scientific societies of Hamburg and Frankfurt contributed over $100,000 towards the expenses. The party is expected to be away about fifteen months.

ASIA

Korea Annexed by Japan. A treaty was signed between Japan and Korea on Aug. 22 by which Japan acquires sovereign rights over the peninsula, which ceases to exist as a state and becomes a part of the Japanese Empire under the name of Chosen. Japan abolishes the consular courts but continues without change for ten years, all the commercial rights that foreigners have enjoyed.

Discoveries in North West Mongolia. A short report which Mr. Douglas Carruthers has sent to the *Geographical Journal* (Oct., 1910) seems to show that he has already accomplished some excellent work in this part of the Chinese Empire. His expedition started, early this year, for the extreme upper basin of the Yenesei. Leaving Minusinsk on the upper Yenesei in May, he traversed the Saiansk and Beikem districts and discovered that the supposed main range of the Saiansk Mts., which appears on the maps as the boundary, in that region, between Siberia and Mongolia, does not exist. Its place is taken by isolated groups of very rough, rugged mountains, apparently a series of disconnected uplifts which occurred in different directions and at different periods. This Mongolian region has a strong affinity with Siberia, not Mongolia. The climate, scenery, people, flora and fauna are all Siberian. Almost imperceptible water-partings divide the river systems, and many glacial lakes not shown on the maps were discovered. Dense forest covers most of the surface and the dry Mongolian flora begins to appear only in the valley bottoms and southern slopes of the hills around Cha-kul. In the heart of the forest are nomads living in birch-bark wigwams and depending for subsistence on their domesticated reindeer. This animal was also found wild, proving that the reindeer is indigenous in this part of the Chinese Empire. As the maps are very inaccurate, the party made a careful survey of the whole route through the upper Yenesei region, some 1,800 square miles being mapped.

POLAR

Norwegian Explorations in Spitzbergen. The *London Times* of Oct. 7 contained an account of the recent explorations in this archipelago by Capt. Gunnar Isachsen's expedition which returned to Christiania on Sept. 18. The land work was done chiefly in the northwestern part of the main island, and the most striking result was the discovery of a not long extinct volcano and hot springs in Bock Bay, a branch of Wood Bay. The details seem to prove that the volcanic cone is at least of Quaternary age and later than the general glaciation of the region. The cone, about 1,650 feet high, is described as consisting partly of lapilli. It is in the neighborhood of a north-south fault that brings Devonian sandstones into juxtaposition with granite. The ice conditions were unusually difficult. Bell Sound, in the south-west of the island, was blocked with ice before the end of August and hunting sloops are now there frozen up.

CLIMATOLOGY

Has the Climate of India Changed? Meteorologists the world over seem to have caught the fever of an interest in climatic oscillations, or changes. This is, doubtless, the natural result of the numerous recent publications coming from geographers and travelers in different regions, in which reference is made to the evidence, or supposed evidence, of climatic fluctuations. Dr. Gilbert T. Walker, Director-General of Indian Observatories, has lately become a con-

tributor to this widespread discussion. In Vol. XXI, Part I, *Indian Meteorological Memoirs* (Calcutta, 1910), Dr. Walker publishes a report on "The Meteorological Evidence for Supposed Changes of Climate in India." It is to be noted that this concerns the *meteorological* evidence, *i. e.,* evidence based upon the records obtained by means of meteorological instruments, and does not deal with physiographic or with traditional evidence. There is much confusion on the part of many writers in their understanding, and in their use of the various kinds of evidence, just as there is confusion as to the relative value of this evidence.

The weakness of the monsoon in northwestern India since 1894 has given rise to conjectures that the climate of that region had altered permanently, and this (supposed) alteration has been explained, at various times, as being due to an increase of irrigation, or to a decrease in forest cover. The Indian Government requested that a report be prepared upon this question, and this was done in January, 1908. The general interest in the matter led to the publication of this report, with the additional evidence given by the data for 1908.

The observations used were carefully selected for their accuracy, and the results are plotted in a series of curves. It appears that there is no proof of any permanent climatic change, but there has been a tendency over a large part of northwestern and central India for the rainfall during the past thirty years to increase to a maximum between 1892 and 1894; to sink to a minimum in 1899, and to improve slowly since that time. The recent deficiency of monsoon rainfall must be attributed to something abnormal in the larger movements of the atmosphere, and not to human agency. The deficiency has not lasted long enough to justify the conclusion that there has been a permanent change of climate. And there are marked indications of a return to good seasons.

R. DEC. W.

A NEW CLASSIFICATION OF CLIMATES. Many suggestions as to a classification of climates have been made in recent years. It is beginning to be difficult to keep the various different schemes in mind. Those who wish to gain a general idea of the classifications proposed up to the year 1906 may refer to "The Classification of Climates, II," (*Bull.* Amer. Geog. Soc., Aug., 1906, pp. 465-477), where maps are also given. Within the past year two new schemes have been suggested, one by de Martonne in "Traité de Géographie physique" who, following about the same lines as Köppen, proposes thirty climates; and the other, a still more recent one, by Penck, "Versuch einer Klimaklassifikation auf physio-geographischer Grundlage" (*Sitzungsber.* k. preuss. Akad. Wiss., phys-math. Cl., 1910, XII, Mar. 3, pp. 236-246). Penck calls attention to the fact that several of the more recent classifications involve an exact knowledge of the individual climatic elements, necessitating long series of meteorological observations. In other words, as most of those who have tried to employ these classifications will agree, they are too complex for general use. For this reason Penck finds in the general conditions of precipitation and in the relations of the land surface to precipitation a simpler and a more rational basis for climatic subdivision so far as the land areas of the world are concerned.

There are three main climatic provinces: I. *humid,* in which there is more precipitation than can be removed by evaporation so that there is an excess in the form of rivers; II. *snow* ("nivales Klima"), in which snow falls in excess of the processes of removal, so that there is transportation by glaciers; III. *arid,* where evaporation eliminates all the precipitation, and could dispose of

still more. Here, therefore, water flowing in from outside can be evaporated. These three principal divisions are separated by two important limits. One of these is the *snow-line;* the other is designated as the *dry-line* ("Trockengrenze"), *i. e.,* the boundary between the humid and arid climates. The "Trockengrenze" is obviously a broader or narrower band, rather than a line.

In the humid climate there are two subdivisions, that with frozen soil and that with ground water. The latter is further subdivided according to the distribution of rainfall, whether this is uniform throughout the year, or irregular. When there is a regular alternation of arid and humid conditions we have the *semi-humid* province (with tropical, subtropical and monsoon districts). Where the distribution of rainfall is uniform we have the *full-humid* ("Voll-humide") province (with equatorial and temperate subdivisions). Similarly, the arid group of climates is subdivided into two provinces, (1) in which aridity prevails throughout the year, or (2) only in certain seasons (fully arid, semi-arid). The *snow* province has a subdivision where snow alone falls ("Vollnivale Provinz") and where rain occasionally falls ("Semi-nivale Provinz").

Professor Penck's scheme commends itself because of its rational basis, and by reason of its simplicity. It will doubtless meet the wishes of many geographers who have been loath to adopt schemes of climatic classification whose meteorological or climatological basis was very complex. R. DEC. W.

BRITISH RAINFALL ORGANIZATION. The British Rainfall Organization, initiated by the late George J. Symons in 1860, and after his death, in 1900, carried on by Dr. H. R. Mill, has, this year, been vested in a body of trustees. This step ensures the continuance of this most important organization for the future. Unique among meteorological organizations, this rainfall service has for years done a work for meteorology and climatology whose value it is impossible to overestimate. Mr. Symons devoted himself heart and soul to the establishment and development of this, his pet and peculiar hobby. Dr. Mill, for the last ten years, has earned the gratitude of his fellow workers in science the world over for undertaking the difficult and responsible task of carrying on the organization. Dr. Mill deserves the further gratitude of meteorologists for ensuring the permanence of the undertaking, and may well be congratulated on the successful establishment of this splendid service on a sure foundation. R. DEC. W.

PHYSICAL GEOGRAPHY

ORIGIN OF CORAL REEFS. In a very suggestive article (*Amer. Journ. of Sci.,* vol. 30, 1910, pp. 297-308), Professor R. A. Daly undertakes to show a possible connection between the development of coral reefs and the presence of glaciation in the northern and southern hemispheres. He shows that atolls and other coral reefs rest on a shallow plateau with an average depth of about 45 fathoms. A possible explanation of this plateau is marine erosion, but a difficulty in the way of this hypothesis is the defence which the reefs themselves offer against the attack of the waves and currents. If, however, the climate were cooler, reef building corals could not flourish in many parts of the ocean where they are now living. Professor Daly suggests that such a condition may have existed during the glacial period, and that during this time, which may have had a duration of from 300,000 years to 1,000,000 years, many of the lower islands of the open ocean were planed off, while the higher islands were notched, in both cases giving platforms on which coral growth could take place.

To account for planation at a depth as great as 45 fathoms, Daly assumes

a lowering of the sea level through the withdrawal of water for incorporation in the great ice caps of the two hemispheres. Assuming an average thickness of ice of 3,000 feet, there would be a lowering of the ocean's surface of about 125 feet, and by the gravitative attraction of the ice there would be a lowering of the level of the equatorial sea about 30 feet more. Taking the area of ice cover as 6,000,000 square miles, and the average thickness of the ice as 3,600 feet, the shift of level of the equatorial sea would be about 30 fathoms. This coincides quite well with the depth of the coral reef platforms and of the lagoons and channels in atolls. It also explains the presence of submerged valleys on the islands that rise above fringing reefs, whose depth never seems to exceed 45 fathoms. These valleys are assumed to be the work of land streams, submerged as the sea level rose with return of water during the disappearance of the ice caps.

Students of coral reefs have brought forth many facts which make it difficult to accept the current theories, either the Darwin-Dana theory, or the Murray theory. This suggested explanation of Daly seems to meet the objections that have hitherto been raised to current theories, and its elaboration will be watched with interest.

R. S. T.

Natural Bridges. It has been a common custom to consider natural bridges as mainly solution phenomena and as associated in the main with phenomena of caverns. It is, therefore, of distinct interest to read the thorough discussion of the subject of the origin of natural bridges presented in an article by Prof. Cleland (*Bull. Geolog. Soc. of Amer.*, vol. 21, 1910, pp. 313-338). This article considers the subject under several headings based upon differences in origin, and in each case it is shown first, how a natural bridge can originate in that manner, and then individual instances are discussed, and many of the cases are illustrated by half-tones. From the analysis of origin and individual instances, Prof. Cleland concludes that natural bridges occur in both glaciated and unglaciated regions, that they are necessarily short-lived structures, and that they are formed in materials of various kinds, including limestone, sandstone, marble, gypsum, conglomerate, marl, clay, shale, schist, and lava. They may be developed in any stage of erosion from youth to early old age, and it is unsafe to make a statement as to the origin of a natural bridge without a careful field study. He recognizes five well-marked divisions on the basis of origin, some of them with several subdivisions. These subdivisions are as follows: (a) By deposition, for instance by the deposit of travertine, or of snow or avalanches across stream courses; (b) by gravity, as when a stone is wedged in a narrow chasm; (c) by wave action differentially eroding along sea or lake coasts; (d) by solution in which seepage, the caving in of superficial tunnels, and the combined action of subaërial and subterranean erosion are the main elements; and (e) by stream erosion. The better known natural bridges of the United States are due to processes operating under one of the two last divisions, the Virginia Natural Bridge, for instance, being the result of solution by seepage, certain Florida and New York bridges resulting from the partial caving in of superficial tunnels, and an extensive series of natural bridges being the product of stream erosion in one form or another. Among the latter causes one of the most interesting is the perforation of the neck of an incised meander, during which the stream, eating out its bank from both sides, actually undercuts the narrow neck until a natural bridge is formed. Such seems to be the case with at least some of the remarkable natural bridges recently discovered in southeastern Utah.

R. S. T.

GENERAL

Honors. The Royal Scottish Geographical Society will award its medal to Prof. James Geikie for his numerous contributions to geographical research and his great services to the society; and the Livingstone gold medal to Sir John Murray for his oceanographical work and to commemorate the completion of the bathymetrical survey of the Scottish freshwater lochs.

Consumption of Nitrate. A Reuter despatch from Santiago, Chile, says that the world's consumption of nitrate, during the past year, amounted to 43,996,996 quintals (about 2,200,000 tons), an increase of about 8,000,000 quintals as compared with the previous twelve months.

Geography and Geology at the Buenos Aires Congress. This Congress was one of the features of the celebration of the centenary of the Revolution of May 25, 1810, and was held in Buenos Aires on July 11-25 last, under the auspices of the Argentine Scientific Society. According to the summary in *Nature* (Oct. 20, 1910), the principal papers in the Geography and Geological section related to Argentina, Chile and adjoining countries. Engineer Luis Riso Patron, Director of Land Surveys in Chile, read a paper on the development of geographical and geodetic work in that country, Prof. Codazzi one on mining in Colombia, Señor Maurtúa spoke on geographical work in Peru, Engineer Machado on petroleum in Chile, Engineer Hermitte and Lieut.-Col. Romero on petroleum in Argentina, and the topography and mineralogy of the Andes were treated in various papers.

The Argentine Meteorological Office presented many interesting papers, chiefly on the meteorology of Argentina and the southern ocean. Its director, Dr. Davis, spoke on the temperature of Argentina as compared with other countries. Prof. Clayton described a new method of forecasting which promises to cover longer periods than is now possible. Profs. Mossman and Solyom spoke, respectively, on the effect of the antarctic currents upon the weather of South America, and the cyclones and anti-cyclones of the South American continent. Dr. Knoche described the organization of the meteorological service of Chile, and Dr. Montessus de Ballore read a paper on a convention of the seismological services of Chile and Argentina. Dr. Negri treated of two seismical laws discovered by himself.

Islands whose Existence is Doubtful. At the meeting of the British Association in September, at Sheffield, Capt. J. K. Davis described the research voyage undertaken by him in the *Nimrod* (May-July, 1909), under instructions from Lieut. Shackleton to try to locate certain islands in the South Pacific shown on the charts. The results of the voyage show that the Royal Company islands, the Nimrod islands and Dougherty island are not in the neighborhood of the positions assigned to them and it is probable that they may safely be taken off the charts. The places where they have been shown on the charts are: Dougherty I., 59° S.—120° 15′ W.; Nimrod Is., 56° S.—159° W.; Royal Co. Is., 50° S.—140° E.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

AMERICA

Agricultural Argentina. Statistics for the year 1909–1910. Prepared by the Bureau of Agricultural Statistics and Rural Economy for the Ministry of Agriculture of the Argentine Republic. 165 pp., index, synopsis, and map. Printing office of the Argentine Meteorological Department, Buenos Aires, 1910.

Comparing the Argentine agricultural system with that of Canada, we may call the latter intensive and must call the former extensive. Thus, in Canada the farms of less than 200 acres constitute 88 per cent. of the total of holdings of rural property; in Argentina the holdings are relatively large, and it appears that farms which best respond to the present conditions of agriculture there are those of 500 to 750 acres. The capital required for farming operations in Canada is $59.25 gold per hectare (2.47 acres), including the value of the land, buildings, and machinery; in Argentina, $27.70 gold per hectare. The increase in land farmed in Canada between 1871 and 1891 was 75 per cent.; the increase in the area devoted exclusively to the cultivation of cereals in Argentina between 1895 and 1909 was 284 per cent. The value of agricultural and pastoral products exported in 1905 was: Canadian exports, $93,331,608 gold; Argentine, $311,278,220 gold.

Such figures as the foregoing arrest attention, especially because the inhabitants of the two countries compared are about equal in number, though the area of Argentina is only one-third as great as that of Canada. Señor Lahitte, chief of the bureau which prepared 'Agricultural Argentina," says that the comparison was deemed necessary in order to explain the *raison d'être* of the Argentine extensive agricultural system, "founded on this principle of rural economy: to obtain the maximum of profit with a minimum of capital and labor." The republic has at present, according to this latest official statement, 19,000,000 hectares of cultivated land. The increase is shown as follows: From 1810 to 1888, only 2,380,000 hectares; from 1888 to 1910, nearly 17,000,000 hectares. Exported products of stock-farming were valued at only $3,300,000 in 1822 and at $71,075,955 in 1888, but in 1909 their value was $153,548,356. The value (in gold) of agricultural and pastoral exports combined was $392,000,000 in 1909.

M. W.

En Amérique latine. 2e Édition. By Henri Turot. Preface by Pierre Baudin. viii and 359 pp., 144 illustrations and 2 maps. Vuibert et Nony, Paris. No date.

M. Henri Turot has written several books beside the present work. He is warmly commended by his fellow-countrymen, for the display of exceptional activity as a traveler and of talent as a writer; but to us, unfortunately, it

seems only too plain that such undeniable gifts were placed on the altar of special interests when he visited Brazil and Argentina. Those are countries that need to make friends everywhere, and have a fairly clear title to the friendship of every great nation. There is opportunity for all in the future development of Brazil and Argentina. We must, however, try to accept without cynical comment the conclusion that we have here, in this attractive volume: special pleading in favor of the extension of French influence (in opposition to the entirely legitimate American interests) throughout southeastern South America. M. Pierre Baudin says in the preface that the great merit of "En Amérique latine" is that Henri Turot depicts a land admirably prepared to receive the French, to follow the lead of France, to love Frenchmen and lavish treasures on them.

"The mission of M. Root and the Pan-American Congress at Rio are two great 'acts' which it would be wrong for us to regard without personal interest. As Henri Turot says very justly (and he was there as an attentive spectator), they were productive of temporary impressions rather than of permanent results. Feeble, separated by violent discord, distressed by revolutions, the southern republics formerly offered themselves as easy prey to the political designs of the north. The latter . . . had not sufficient knowledge to see all the chances that offered themselves to her at that time. To-day she is evidently impressed by the awakening of these countries endowed with incomparable natural resources . . . But her *clairvoyance* appears to be tardy and too selfish. She is suspected. The republics commence to feel their own power and they know their good fortune. Their tendency is rather to follow such affinities as appeal to them through community of race and of civilization than the inaffective and inferior territorial relationship. Without repulsing the overtures of their great neighbors, they yield more willingly to their inborn predilection for their great Latin sister. They come to France. They invite the French to visit them. They prefer the French language. They crave the instruction of our teachers, the advice of our statesmen. They adopt our fashions, our literature, our drama. They only ask that they may share the overflow of the enormous accumulations of wealth in France . . ."

In the chapter entitled "États-Unis et Brésil" the author says: "Did the United States have the idea of forming a league between North America and South America, for the purpose of boycotting European products? That is possible. But in any event they quickly perceived the assured failure of such an attempt, and they gave it up. In fine, if M. Root desired for political reasons a sort of American confederation stretching from the mouth of the Hudson to the Straits of Magellan, he easily acquired the conviction, in the course of his voyage, that such a project cannot possibly be realized. Was it this *déconvenue* which inspired the attitude of the United States at the last Hague conference? I do not know. But at any rate it is well to mention that, when wishing to establish categories among the states there represented, the North American delegates, by proposing to put Argentina and Brazil in the rank of powers of the fourth or fifth class, cruelly wounded the pride of those whom they were anxious to captivate the year before. Great was the anger felt throughout Brazil on reading the debates in regard to the tribunals of arbitration . . . On the other hand, the prestige of France was enhanced in the eyes of the Brazilians who saw M. Leon Bourgeois seconding with all his ability—for the reason that they were just—the opinions of M. de Rio Branco, so eloquently brought forward at the Hague by the Brazilian senator, Ruy Barbosa."

The Mississippi River and Its Wonderful Valley. By Julius Chambers. 308 pages, maps and 80 illustrations. G. P. Putnam's Sons, New York, 1910. $3.50.

So great is the interest in the possibilities of the Mississippi as a highway of commerce, so hopeful are the people that our facilities for transportation are not to be wasted and so eager is the desire for a sane solution of the problem of waterways, that this last book on the Mississippi will be, at first, somewhat of a disappointment, for it hardly rises to the present interest in the river. Less than a dozen pages on the present evolution of a great river system hardly warrants so inclusive a title as is given to this book. On the other hand, commercial possibilities and conservation of power may sometimes cause us to lose sight of the romance of earlier days. Many steps in the history of the river are narrated here and new light is given on some chapters of the story.

Back in the "era of fable" the account begins and the rumors and first indications of the river, as shown by European explorers, form the first chapter, a "conjectual period," of the history. Then follow accounts of the explorations of De Soto, Cartier, Allouez, La Salle, Joliet, Marquette, Hennepin, St. Cosme, Iberville and La Seuer. The discovery of the headwaters has considerable attention, and an account of a voyage in 1872 down the entire length of the river is interesting as a picture of the Mississippi, previous to any attempt to control it. The choice of material, however, is not always happy, as *e. g.*, when 50 per cent. of the account of the journey from St. Louis to New Orleans is filled with a second-hand gambling story. "The Mississippi in War" is the heading of a long chapter which treats of the struggles with the Indians, the defeat of the British at New Orleans in 1815 and the battles of the Civil War, especially those about Forts Henry and Donelson, Shiloh, New Orleans and Vicksburg. Many other affairs of the river are briefly mentioned, as the Louisiana Purchase, Lewis and Clark, Itasca State Park, the Delta and the "Mississippi Bubble." The volume closes with an historical account of the large cities along the river. The pictures are clear and well chosen; many of them are recent views and present what the text has somewhat neglected, the present aspect of the river.

R. M. B.

AFRICA

Die Pflanzenbarren der Afrikanischen Flüsse. (Münchener geographische Studien, No. 24). Von Dr. Oswald Deuerling. iii and 253 pp., 14 photo-engravings, 2 maps, bibliography and index. Theodor Ackermann, Munich, 1909. M. 5.

This is a very careful study of the blockading of river channels by vegetation, and especially in the Nile basin, where the sudd has frequently formed an impenetrable barrier to navigation until artificially removed. Due attention is given to these impediments in the rivers of the several continents, but the sudd of the Nile is most thoroughly discussed as to its manner of formation, the varieties of vegetation that enter into its composition, its distribution and the methods of removing it. The bibliography of the subject is remarkably full, embracing nearly 1,000 titles, and an appendix gives a list of the plants with descriptions of many of them. The monograph is the most comprehensive study of the whole subject that has yet been written and is a gratifying contribution to this phase of physical geography. The photo-engravings are illuminating. The black sketch maps (1 : 1,000,000 and 1 : 4,000,000) show the basins of the upper Nile and its tributaries in which the phenomenon is observed.

Au Tchad. Trois Ans chez les Senoussistes, les Ouaddaïens et les Kirdis. (2nd Edition). By Capitaine Cornet. 325 pp. and 26 photo-engravings. Plon-Nourrit & Co., Paris, 1910. Frs. 4.

Captain Cornet has been one of the foremost of the French military pioneers in the region of Lake Chad among the fanatical followers of Islam. He has had a very prominent part in the difficult task of establishing the French régime among these peoples, a work that is now practically concluded; and we may now expect the beginnings of some progress there along modern lines. With security for the people, the abolition of the slave chase and the development of agriculture and stock raising, there is promise of better times for these natives of the Central Sudan, whether France profits much or little by the transformation.

This book includes the simple diary of Capt. Cornet, written in his tent after the day's events, which were sometimes particularly stirring. He tells of his hunting adventures, his combats, his perilous journeys, the chiefs he met and he sketches the Sudanese, giving graphic descriptions of their ways of life, their ideas, the motives that actuate them, their industries and trade. On the whole, the book gives us a good idea of what he saw and learned and concluded about an almost unknown part of the world during the three years that he was in the front of French activity there.

ASIA

Fifty Years of New Japan. (Kaikoku Gojūnen Shi.) Compiled by Count Shigénobu Okuma. English version edited by Marcus B. Huish. Two Volumes. Vol. I: xi and 646 pp.; Vol. II: viii and 616 pp., 5 Appendixes, Map, and Index. E. P. Dutton & Co., New York, 1909. $7.50.

The book is a record of the fifty years subsequent to the opening of Japan to foreign intercourse, and in this English edition the information is carried as near to date as public statistics allow. The foremost contemporary authorities of Japan have combined to write each, on the departments of their particular activity and experience, and, as in order to better understand the present, it has in most chapters been necessary briefly to trace the conditions of the past, this narrative of New Japan is, at the same time, a résumé of the whole history of Japan from the earliest times to the present day. Those who still cling to the opinion that the "Europeanization" of Japan is in reality nothing but a superficial veneer underneath which the radically different character of the people is concealed, will have to readjust their judgment after having read this book. It is not because the combined efforts of the distinguished authors—all of them enthusiastic believers in the New Japan, and most of them devoted ministers of the new Gospel to their people—have been successfully enlisted to convince the white reader of the possibilities of his yellow brethren. Anybody endowed with the gift of rhetoric may persuade others to share his belief; but the very way in which this record of Japan, the old and the new, or rather the old *in* the new, appeals to the western mind is in itself a proof that "the scion belonged to a genus allied to the stock," or the tree could not have borne such fruit. In fact, if we did not see the Japanese names, there is no word, no phrase, no shade of thinking in the whole book that might lead the reader to suspect that it was not an Englishman, or German, or American, or any other descendant of Old-World civilization that was speaking to him through the pages of the book. No doubt one of the contributors is right in saying that the intellectual progress

of races as well as individuals depends on what was previously known to the person or race taught. The example of Russia, 200 years after the introduction of Western civilization, when compared to Japan, fifty years after a similar change, is perhaps the best illustration of that rule. If Japan borrowed of our civilization, she also knew what to borrow, and how.

These ideas are the keynote of every chapter in the book, no matter what its subject. The authors firmly believe that there was a certain affinity, a natural preparedness in Japan that enabled her, not to imitate, but to assimilate Western civilization as soon as she had a chance. The hypothesis of an admixture of Hindoo blood is hardly necessary to explain it. The whole past of the country shows a mental disposition of the people to assimilate whatever it found that was good in neighboring civilizations; for it must not be forgotten that the exclusion policy was, in 1854, only 200 years old, that it had been caused by the indiscretion of the Jesuit missionaries then at work in Japan, and that up to that moment Japan had entertained a very lively exchange, material and intellectual, with all the nations she came in contact with, not excepting the Christian powers.

Especially from the latter they had imbibed, through the intermediation of the Dutch and Portuguese, not a little of Western philosophy and science, and even during the seclusion period there were many among the educated classes who tried, at the risk of severe penalties, to obtain for themselves and their people what little they could of Western knowledge, especially in medicine. Thus the nation was far from unprepared for the new light when dawn broke in 1854, and their inherited talent of adopting and adapting foreign blessings did the rest. After having received and assimilated the philosophies of Confucius and of Buddha, there is no reason why Japan should not as readily receive and assimilate that of Christ, and the transplantation, on Japanese soil, of European customs, science, and literature, need not endanger the nation any more than did those of China 1,500 years ago. That, with all these foreign exchanges, Japan preserved her national unity and the unity of her intellectual life is doutbless due to her insular seclusion and the favor of her soil and climate which enabled the people, undisturbed by enemies from without, and having plenty of all they needed, to lead contented and happy lives in which initial differences were gradually obliterated. It is this environment of harmony and contentment which produced, probably, that felicitous spirit of eclecticism which taught the people to examine everything and to keep what was, for them, the best. There is no reason why this faculty of assimilation should be less strong to-day than in the past; and if to-day we still perceive, in many respects, what might be called chaotic conditions it is because the period of transition is not yet ended—not because Japan is not able to assimilate the new.

It is impossible, in a short review of such a book, to enter upon any details; a few words on the contributors and their respective subjects must suffice to give an idea of its contents. Count Okuma himself gives an abstract of the history of Japan and the views of the last Shogun on the Restoration; these are followed by chapters on the political, military, naval, financial, legal, commercial, industrial conditions by Prince Ito, Count Soyéshima, Field Marshal Prince Yamagata, Admiral Count Yamamoto, Members of Parliament, University Professors, the Mayor of Tokio, the President of the Japanese Steamship Company, the President of the First National Bank, and other authorities on the respective subjects. The second volume contains chapters on the language,

religious beliefs, culture and education in old and new Japan, the development of European and Japanese Arts and sciences, on Journalism, Social changes in new Japan, the influence of the West upon Japan, etc., by similar authors; and a conclusion by Count Okuma. Each of these articles having been composed independently of the others, it is inevitable that they should overlap in some places; but the reader who does not yet know everything about Japan will hardly consider this a defect in the book, and it becomes most interesting when the opinions of the respective authors differ from each other as, for instance, in the explanation of the motives of the Shogun in resigning his office. One who has read the book carefully will feel that he knows Japan as well as anybody can know it without having lived there. What is worth more, however, is the feeling that we take along after having read the book, a real mental kinship with those who are behind it. Admitting that they are the select few who stand at the top, a nation of still half primitive people clad in borrowed rags of foreign origin could not have provided even these few who see with our eyes, hear with our ears, and speak our language—not philologically alone, but mentally. The best guarantee for the genuineness of the spirit that animates them is, perhaps, the way in which they conceive their great problem: not as the Europeanization of Japan, but as the Japanization of European civilization. With such leaders the next fifty years will probably produce even more startling and more creditable results in the progress of Japan than those recorded in these volumes. M. K. G.

Chez les Lamas de Siberie. Par Paul Labbé. 207 pp., 38 photo-engravings and sketch map. Hachette & Co., Paris, 1909. Frs. 4.

The devotees of Buddhism in the Russian Empire are the Kalmuks of Astrakhan and the Buriats of Transbaikalia, Mongol peoples who, with the Kirghiz, are in the front rank of the Siberian natives. The form of Buddhism that the Buriats profess is that which is practiced in Tibet. There are thirty-four lamaseries in Transbaikalia and there Mr. Labbé lived for many months, improving the opportunity to make a thorough study of Lamaism in that part of the world. Quite in contrast with the treatment which European travellers have received in the lamaseries of Tibet, the Frenchman was very hospitably welcomed, his many questions were readily answered and he was permitted to take numerous photographs. He has written an instructive book about these Buddhists and their large monasteries and, incidentally, he gives a good account of Transbaikalia, a region that is destined to be the home of many thousands of Russion immigrants.

A Woman's Impressions of the Philippines. By Mary H. Fee. vi and 291 pp., and 32 photo-engravings. A. C. McClurg & Co., Chicago, 1910. $1.75.

It is a long way from San Francisco to Manila and the author fills 44 pages with the story of the journey. It is the commonplace of the globe-trotter, and those who wish may skip it for the instructive and entertaining pen-pictures that fill the remainder of the volume and make it well worth while. The book is an account of native life, and its environment as seen by the author, who was long a teacher in the islands and became especially well acquainted with the middle class natives. Few of the many recent books on our new possessions give so clear an insight into the nature of the Filipinos. Its pages are enlivened,

by the way, by bright humor and by many an incident that not only illustrates a fact or idea but is, also, very comical.

Beiträge zur Kenntniss der Eiszeit in der Nordwestlichen Mongolei und einigen ihrer südsibirischen Grenzgebirge. Von J. G. Granö. iv and 230 pp., 9 maps, 19 plates, and 18 figures in the text. *Fennia,* Vol. 28, No. 5, Helsingfors, 1910.

The geomorphological studies, the results of which are recorded in this monograph, were made by Prof. Granö in 1905-07 and 1909. At a time when the study of the Ice Age in Europe and America is so far advanced, this notable contribution to similar studies in a part of Asia where questions of glacial geology have not yet been answered will be read with interest.

Les Indes Néerlandaises. Par Antoine Cabaton. viii and 382 pp., map and index. E. Guilmoto, Paris, 1910. Fr. 8.

A clearly written, readable and precise account of the Dutch East Indies. The book should be useful in wide circles for there seems to be no other work that serves precisely the same purpose. Most summaries of considerable parts of the world are dry as dust but this work does not belong to that category. It is a book not merely for reference and study but for general reading and it contains the quintessence of many years of research by many investigators, official and otherwise, as to these wide-strewn islands, their geology, geography, peoples, resources, communications, trade, development, government, etc. Each topic is sufficiently amplified to give a good idea of it in its most important bearings.

Chez les Jaunes. Japon, Chine-Manchourie. Par Jules Leclercq. 301 pp. and 16 photo-engravings. Plon-Nourrit & Co., Paris, 1910.

Mr. Leclercq, former President of the Royal Belgian Geographical Society, is a great traveller who has written many volumes describing various parts of the world as he has seen them. There is no flavor of the globe-trotter about this or his earlier narratives, for the information he gives is worth while, well compacted and, at the same time, of very readable quality. No one can read such chapters as those on Hankow, Peking and the railroad connecting them, without receiving clear and accurate impressions that will linger in the memory.

EUROPE

In Unfamiliar England. A Record of a Seven-Thousand-Mile Tour by Motor of the Unfrequented Nooks and Corners, and the Shrines of especial Interest in England; with incursions into Scotland and Ireland. By Thos. D. Murphy. vii and 390 pp., Illustrations in color and from Photographs, 2 maps and Index. L. C. Page & Co., Boston, 1910. $3.

This is the record of an automobile trip through unfrequented nooks and corners of England made by the author. His itinerary is extensive, 7,000 miles in one summer, in all parts of the United Kingdom. So much, of course, can be seen during such a trip that an author is in danger of losing the perspective of his story in a mass of detail. Such seems to be the trouble with this account, which fails to leave on the reader's mind a picture at once coherent and entertaining. Scattered through the book are many bits of anecdote and adventure,

but the writer has tried to see too much, or to tell too much, and the reader sees only a confused vision of hilly roads, vanishing castles, and more or less hospitable inns. It may be that English landscape in itself is hardly well suited to so speedy a means of travel. Much of the delicacy of the picture must inevitably be lost on the motorist, which the pedestrian, for instance, would see and enjoy. It may be set down as an axiom of travel that the distinctness of the impression is in inverse ratio to the speed of progression. English scenery is not built on the thirty-mile an hour plan.

However, the book is well illustrated with sixteen color plates after famous paintings of landscape, and with forty-eight duogravures, of which the author is justly proud. The modest preface would disclaim any intention of producing a serious contribution to geographic travel; as a motor trip, it should prove of value to those who plan a like vacation. Two sketchy outline maps assist the reader in tracing the motor's erratic course, and are drawn to combine on one chart the author's former wanderings, described in "British Highways and Byways from a Motor Car," with those of the present volume. S. A. H.

Grèce. Par Gustave Fougères. (Guides-Joanne.) lxxxv and 514 pp., 23 maps, 46 plans and 25 illustrations. Librairie Hachette & Co., Paris, 1909.

In the present edition of this standard guidebook the number of maps and other illustrations has been increased and the volume has been thoroughly adapted to the needs of the tourist of to-day, who is finding Greece more fully open to him now than it was only a few years ago. The new Hachette maps and plans fully maintain the reputation of the publishers.

Lysing Islands. Eftir Torvald Thoroddsen. [The Physical Geography of Iceland. By Torvald Thoroddsen.] Vol. 1 and Vol. 2, part i. Vol. 1, vi and 368 pp.; Vol. 2, part i, 240 pp. Sketch maps and illustrations. S. L. Möller, Copenhagen, 1907-09.

This work, when completed, will comprise the results of Dr. Thoroddsen's long studies of the physical geography of Iceland, a subject which he has made his own and parts of which he has already treated in many papers. An account of his book is reserved for its completion.

Pompeii. Painted by Alberto Pisa. Described by W. M. Mackenzie. xii and 180 pp., 20 illustrations in color, 4 in black and white and 2 sketch plans and index. A. & C. Black, London; The Macmillan Company, New York, 1910. $2.50.

A book that may be read with pleasure and profit. It is neither a guide-book nor an archæological treatise, but a scholarly and painstaking effort to describe, as far as extant materials and admissible analysis and inference will permit, the life of the old town. Such a reconstruction of Pompeii, of course, involves account and explanation of the material revealed by the excavation of the city. The fine views in colors of the ruins and the plans of the excavated quarters and of an *insula* or isolated unit of buildings, add much to the value of the book.

Au Pays de Mgr. de Laval. Par l'Abbé Auguste Gosselin. vii and 360 pp. Laflamme & Proulx, Quebec, 1910.

Eighteen letters graphicaly descriptive of what the author deemed most noteworthy in his travels in France and visits to Rome and Interlaken.

POLAR

Rapports préliminaires sur les travaux exécutés dans l'Antarctique par la mission commandée par M. le Dr. Charcot de 1908 a 1910. Dr. J. Charcot. *Comptes Rendus* de l'Académie des Sciences, 1910, pp. i-xi, 1-103.

Although Dr. Charcot's expedition returned to France in June, the preliminary report upon the studies of the past two years has already been issued. This résumé of scientific observations made on the *Pourquoi-Pas,* is thus issued to supplement the long series of beautiful monographs which have appeared discussing the scientific observations made on the voyage of the *Français.* While two summers and a winter were spent in the Antarctic, no attempt was made to attain the pole, the objects of the expedition being purely geographic and scientific. The present report outlines only, and is in the main a series of résumés of monthly journals made on board the ship.

The expedition wintered at Petermann Island, off Graham Land. During the first summer, a cruise was made along the detached land masses of West Antarctica which had been discovered by the *Belgica* and *Français* expeditions. As a result of these surveys several lands which in order from northeast to southwest have been called Louis Philippe Land, Danco Land, Graham Land, and Loubet Land, are clearly shown to be parts of a common continent whose coast land has been extended southward past Adelaide Island for between three and four degrees to a point south of the Antarctic circle. This part of the continent is separated from Alexander Land lying to the westward by some two degrees of longitude, so that the latter must now be regarded as an island perhaps 100 miles across in its greatest dimension.

The cruise of the next summer discovered land some hundred miles to the southward of Alexander Land (in lat. 70° and long. 77° W.) and the name Marguerite Bay has been given to the great bight in which Alexander Island appears to occupy the center. The most important result of the expedition was the skirting of an "ice wall' extending to longitude 126° W. in a direction nearly due west and approximating to the parallel of 70°. In this long distance land was once seen in Pierre Island (long. 92° W). Soundings along this course supplement the observations of earlier Antarctic expeditions and show that a submerged platform lies to the west of West Antarctica, though this marginal shelf has marked relief and is notably different from that which is common to the other continents. In all, about one hundred soundings were made, of which thirteen were in excess of 1,000 meters. Outside the submerged platform a great fosse was discovered, having a depth of more than 5,000 meters, and this decreased in depth toward the west.

The report is searched in vain for any clear indication of true shelf ice, though the banquise is described as being in places three meters in thickness and as giving birth to large ice blocks or floes which were more or less shattered at the moment of birth.

Gravity determinations were carried out at six widely separated stations (two in South America), and while they are not yet ready for publication, it is announced that they indicate some differences from the theoretical results based upon Helmert's formula. A seismograph was set up at the winter station for eight months and interesting observations were made.

M. Gourdon, who furnished the admirable report upon the physical geography, glaciology, and meteorology of the *Français* expedition, was again the

geologist with Dr. Charcot, and his summary of results indicates that new and interesting reports are in prospect.

The monthly summary reports are divided into seven sections, viz.:

I. History of the voyage and general monthly report by the commander.
II. Hydrographic work, astronomical, pendulum, and seismographical observations (Bongrain).
III. Tides, coastal hydrography and chemistry of the air (Godfroy).
IV. Meteorology, atmospheric electricity and physical oceanography (Rouch).
V. Terrestial magnetism, actinometry, and photography (Senouque).
VI. Geology and glaciology (Gourdon).
VII. Zoology (Lionville).

The report is concluded by a series of meteorological tables and a list of soundings.

W. H. Hobbs.

Roald Amundsen's "The North West Passage." Being the Record of a Voyage of Exploration of the ship "Gjöa", 1903-1907. By Roald Amundsen. With a Supplement by First Lieut. Hansen, Vice-Commander of the Expedition. 2 Vols. xxii and 732 pp., 139 illustrations. 3 maps, supplement and index. E. P. Dutton & Co., New York, 1908.

The popular account, finely produced, of Amundsen's famous Arctic expedition, whose results have been summarized in earlier volumes of the *Bulletin.*

GENERAL

The Conquest of the Air. By A. Lawrence Rotch. 192 pp., 36 illustrations and index. Moffat, Yard & Co., New York, 1909. $1.

Mr. Roach was the founder and is the Director of the famous Blue Hill Meteorological Observatory. No one could be better qualified than he to write the chapter on "The Ocean of Air," which opens the book and in which he shows the interdependence of meteorology and aëronautics. In the other chapters he gives thirty pages to the history of aërostation, forty-eight to a description of the varieties of the dirigible balloon, forty-one to the flying machine, and twenty to the future of aërial navigation, in the light of expert and conservative opinion. He believes that the dirigible balloon has nearly reached the limits of its development and enumerates seven particulars in which improvements in the flying machine are necessary. The perusal of this clearly written and authoritative little book will add to the intelligent interest of the millions who will have an opportunity, in the next few years, to watch the flights of air-ships.

Soil Fertility and Permanent Agriculture. By Cyril G. Hopkins, Ph.D. xxiii and 651 pp., 14 illustrations, appendix and index. Ginn & Co., Boston and New York, 1910. $2.75.

All who have to do with the production of farm crops should use this book. It is somewhat technical, as really good books of this kind must be, but anybody of ordinary common sense and intelligence will understand the book if he will study it. It is packed with facts and principles, deals largely with soil investigations by culture experiments, treats of the essential factors of success in farming, gives statistics of agricultural products and bestows adequate atten-

tion upon every phase of questions relating to soil fertility and the science of increasing the productivity of the land while, at the same time, drawing heavily upon its resources. The author is Professor of Agronomy in the University of Illinois.

Fungous Diseases of Plants. With Chapters on Physiology, Culture Methods and Technique. By Benjamin Minge Duggar. xii and 508 pp., 240 illustrations and index. Ginn & Co., Boston, 1909. $2.

This important work is the first book on the subject of American origin. The author is Professor of Plant Physiology in Cornell University. His book is designed for reference use and as a text in the higher schools. It has already been adopted in a considerable number of these institutions. Each disease is discussed as to its occurrence, the nature of the injuries induced, the structure, life history and cultural relations of the causal fungus and practical methods for prevention or control.

Meteorologie. Von. Professor Dr. Wilh. Trabert. Small 8vo. (Sammlung Göschen, No. 54.) Dritte verbesserte Auflage. G. J. Göschen, Leipzig, 1909. 80 Pf.

We are glad to welcome the third edition of Trabert's excellent little volume. The first edition appeared in 1896; the second in 1901. The author has revised the text in order to keep pace with the rapid advance in the science of meteorology, and we note particularly the sections which deal with the vertical decrease of temperature, and with atmospheric electricity. It is safe to say that the careful student of the book will gain a very good idea of the general principles of the science. We commend the book to American readers.

R. DEC. W.

Life of Admiral Sir Leopold McClintock. By an Old Messmate, Sir Clements Markham. viii and 370 pp., portraits, maps, illustrations, appendices and index. John Murray, London, 1909. 15s.

The story of one of the great heroes of British exploration, written by the geographer and Arctic authority, who, probably, was best qualified to render this service to McClintock's memory. The man whose life is here told had natural gifts that enabled him, as an explorer, to strike out new paths and accomplish results by ways of his own devising. The world at large has known him chiefly for his voyage on the *Fox* and his discovery of the fate of Sir John Franklin. In this volume we have not only the history of his achievements but gain also an insight into the facts of his development and the training that helped to fit him for a conspicuous career.

Causal Geology. By E. H. L. Schwarz, A.R.C.S., F.G.S., Professor of Geology at the Rhodes University College, Grahamstown, South Africa. vii and 248 pp., 34 illustrations or figures, and index. Blackie & Son, Limited, London, and D. Van Nostrand Company, New York, 1910. $2.50.

In a series of uncommonly interesting chapters, Professor Schwarz develops his views in regard to some of the most important geological problems. We are invited at the outset to consider five postulates: 1, The rocks on the surface of the earth are in constant motion; 2, The force of cohesion in rocks is insufficient to keep them rigid when in large masses; 3, The area of the surface

of the globe is not a diminishing one; 4, The surface of the earth is uniform in average texture throughout; 5, The earth is growing by the addition of meteoric matter, and the composition of the earth as a whole is represented by the average composition of this matter. The subject of the second chapter is the source of the earth's rocks. Other leading topics to which the author devotes entire chapters are: The building of the earth, water and the work of surface water, the soil, the atmosphere, the work of underground water, heat, earth folds, the earth's surface, pressure, cold volcanoes, normal volcanoes, earthquakes, the Archæan rocks; and in chapter xvii we find a summary that concludes with these words:

"Although we have in this book dealt with almost all the large problems in geology, we have in no one case found that the explanation of the cause for the production of the phenomena could be helped in any way by the assumption of a hot interior of the globe. The facts observed in the field or recorded observations explain, without bringing in any unknown factors, the whole of the causes which produced them, if they are allowed to range themselves in proper order. In no one case have we called in the aid of pure speculation, such as the nebular hypothesis. In all cases we have endeavored to arrive at our explanations in the simplest possible way; thus, if meteorites do fall on the earth, it is surely legitimate to take them as average samples of the interstellar matter out of which our earth has grown. Then, when we find that when the volcanic pipes dip sufficiently deep in the earth the same material comes up to the surface, there is enough proof to establish the definite conclusion that the earth's interior must be unaltered meteoric material. If I may use an illustration from the history of literature, the present work constitutes an appeal for a return to rationalism after a period of romanticism. I use these terms in the sense in which they are applied in literary criticism. I do not mean that the theoretical enigmas with which geology is burdened at the present time are pure romance, but that the dominant factor has been theoretical conceptions which have had no basis in fact, and that the fundamental theories of modern geology stand in the same relation to logical deduction from facts as romanticism stands to rationalism in the domain of literature."

We think that many readers will turn with special interest to the brief account of the radium content of rocks, and the following deductions:

"From Joly's figures there can be no doubt left in one's mind that radium has at any rate a very great influence on the temperature observed in rocks, if it is not entirely responsible for all of the heat in the earth's crust. But the work of Strutt [R. J. Strutt, "On the Distribution of Radium," etc., *Proc. Roy. Soc.* Ser. A. vol. *lxxvii*, 1906, p. 479], who initiated this kind of research, is still more positive . . ."

"The heat of the earth's crust we ascribe to the presence of radio-active substances, which, if estimated at radium alone and existing generally only in quantities such as rocks poor in radium indicate, would require an envelope of 45 miles of rock-containing radium. If the radium content of the crust be estimated a little higher, an envelope of 20 or 30 miles would be sufficient. But besides radium, there are the continual movements in the earth's crust, caused by the weighting of the crust by sediments and the lightening of continental regions by the carrying away of rock-waste; these differential movements cause the segments of the earth's crust to move and to rub one against the other, and consequently heat is developed."

Professor Schwarz ascribes the deductions in this work which differ from accepted explanations to his long-sustained association with geological phenomena in the field; and he calls attention to the circumstance that geological problems are presented to the student in an exceptional way in South Africa, or the regions which were the scenes of the activity of the Geological Commission of the Colony of the Cape of Good Hope. Practically the whole country is bare of soil, and enormous gashes sawn through the land by the rivers reveal very large sections and reveal them very clearly. As year after year went by in such "association," the facts presented themselves to Professor Schwarz in an order different from that which one usually finds in text-books, and therefore the theories as to their origin and nature became different from established ones.

M. W.

A Brief History of Forestry in Europe, the United States and Other Countries. By Bernhard E. Fernow, LL.D. x and 438 pp. University Press, Toronto, 1907.

This is an authoritative reference volume for foresters and others, summarizing the forest conditions and forest management of Germany, Austria-Hungary, Switzerland, France, Russia and Finland, the Scandinavian States, the Mediterranean States, Great Britain and her colonies, Japan and the United States. Originally planned as a series of lecture notes, it is concise, closely written and hence especially valuable as a reference volume, in spite of the absence of an index.

The larger chapters are devoted, as would be expected, to Germany and the United States. While Germany has had a forest policy since the 14th Century, there was no developed public opinion in reference to the need of forest control in this country until within very recent years. In certain areas, early efforts were made to care for the forests, but they were purely local and the first forestry association was formed in 1876. The chapter summarizes the movement in the United States up to 1907.

As a book for the forester, the volume is a splendid summary of national movements all over the world. It is also a valuable volume of reference for all who are interested in the pertinent and much misunderstood subject of forestry as it confronts the people of the United States.

R. E. D.

The New Baedeker. Being casual Notes of an irresponsible Traveller. By Harry Thurston Peck. 352 pp. and illustrations. Dodd, Mead & Co., New York, 1910. $1.50.

The New Baedeker is a volume of conversational notes on selected foreign and American cities, written in a sort of itinerant order. The author does not pretend to give the spirit of the cities so that one may feel the personality of Berlin, Havre or Boston, but describes the items of thought or allusion that come to him in watching the details of life amid which he has been placed in his travels. These running comments are often amusing, occasionally picturesque, but frequently far-fetched and unattractive.

The volume contains little information that would help a traveller and thereby illustrates the difference—hardly a sufficient word—between the New Baedeker and the invaluable Baedeker which is world-known and world-used.

R. E. D.

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Bolivia-Peru. South Peru and North Bolivia. Including the rubber yielding Montaña. 1:2,000,000=31.56 miles to an inch. 4 colors. With paper, "The Land of the Incas," by Sir Clements R. Markham. *Geogr. Journ.*, vol. 36, p. 512, 1910. [Compiled in the map department of the Royal Geographical Society. The map embraces about 418,000 square miles and most of the material was map sketches or route traverses. The compilation and drawing of the map took the greater part of two years.]

Brazil. Vorläufige Skizze zu Col. Candido Rondons Expedition Cuyabá nach dem Madeira. 1:7,500,000=118.37 miles to an inch. 2 colors. With paper, "Col. Candido Rondons Expedition im Brasilischen Hinterlands," by H. Wichmann. *Pet. Mitt.*, 56 Band, Heft V, Tafel 47, 1910.

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Peru. Der Mittel-und Unterlauf des Ucayali mit seinen Zuflüssen. (a) Nach A. Raimondi's Karte von Peru 1887 in 1:500,000 und der Karte von Pedro Portillo, 1907 in 1:1,000,000; (b) Nach der Aufnahme von Richard Payer, 1886. 1:1,500,000=23.67 miles to an inch. With paper, "Vom Ucayali nach den Bergen von Condamana." *Pet. Mitt.*, 56 Jahrg., II Halbband, 1 Heft, Tafel 8, 1910.

PERU. Das Quellgebiet des Amazonas-Marañon. 1:1,000,000=15.78 miles to an inch. By Dr. Wilhelm Sievers. Black. With paper. "Die Quellen des Marañon-Amazonas." *Zeitsch.* f. der Gesells. f. Erdk. zu Berlin, No. 8, Tafel 7, 1910. [Sketch map of the source region. Dr. Sievers locates the ultimate source of the Marañon-Amazon on the snow mountain San Lorenzo about 10° 29′ S.; 36° 37′ W.]

VENEZUELA. Karte der Umgebung von Caicara in Venezuela. 1:250,000=3.95 miles to an inch. By T. A. Bendrat. 4 colors. Geol. profile of Orinoco river bed at and near Caicara. With paper, "Studien in der Umgebung von Caicara am Orinoko," same author, *Pet. Mitt.,* 56 Band, Heft V, Tafel 46, 1910. [Based on Bendrat's astronomical and trigonometrical observations.]

AFRICA

AFRICA. Eisenbahnen und Wasserstrassen in Afrika. 1:25,000,000=394.5 miles to an inch. 3 colors. With paper, "Transkontinentale Bahnen und die Kap-Kairo-Linie," by Dr. R. Hermann. *Geogr. Anzeiger,* II Jahrg., Heft ix, 1910. [Shows R.R.s in operation, building and planned and the navigable stretches of rivers. A good map though it fails to show the R.R. now extending into Northern Nigeria; nor does it indicate as navigable the upper Lualaba-Congo though the Belgians report that it is navigable for 400 miles (light draught vessels) above Kongolo.]

ALGERIA-MOROCCO. Schauplatz zukünftiger französisch-marokkanischer Verwicklungen an der algerisch-marokkanischen Grenze. 1:2,500,000=39.46 miles to an inch. 3 colors. With paper, "Militärgeographische Skizze der algerisch-marokkanischen Grenzgebiete," by D. Hübner. *Pet. Mitt.,* Band 56, Heft V, Tafel 49, 1910.

BELGIAN CONGO. Part of the Kasai Basin. 1:1,500,000=23.67 miles to an inch. By E. Torday. 2 colors. With paper "Land and Peoples of the Kasai Basin" by same author. *Geogr. Journ.,* vol. 36, p. 128, 1910.

IVORY COAST. Carte politique de la Côte d'Ivoire. Montrant la marche de la pénétration et de la pacification depuis le 1er mai, 1908. 1 inch=71.3 miles. Black. With paper, "La Pacification de la Côte Ivoire." *Renseign. Col.,* No. 10, 1910. [Symbols show the regions under the French régime and those still to be explored and pacified.]

NIGERIA-CAMEROONS. Nigeria-Cameroons Boundary Survey, Yola-Cross River. 1:1,000,000=15.78 miles to an inch. Reduction from Boundary Commission Map, 1907-09. 3 colors. List of trigonometrical stations giving their coordinates and elevations. With paper, "The Yola-Cross River Boundary Commission, Southern Nigeria," by Major G. F. A. Whitlock, R.E. *Geogr. Journ.,* vol. 36, p. 512, 1910. [An inset chart shows the triangulation.]

PORTUGUESE W. AFRICA. South West Africa. Route of C. C. Bissett and J. W. Baker White in 1907-8. 1:1,500,000=23.67 miles to an inch. 3 colors. *Geogr. Journ.,* vol. 36, p. 248, 1910. [The map, from a prismatic compass sketch, covers the northern Mambukushu country.]

SUDAN. Route of Dr. Karl Kumm across Africa from the Niger to the Nile, 1908-1909. 1:7,500,000=118.37 miles to an inch. 3 colors. With 2 insets of parts of the route on scales of 1:1,250,000 and 1:3,750,000. With Paper, "From Hausaland to Egypt through the Sudan," by Dr. Kumm. *Geogr. Journ.,*

vol. 36, p. 248, 1910. [Shows the routes of Dr. Kumm, Capt. Boyd Alexander, and Dr. G. Nachtigal. Based upon a compass traverse adjusted to positions and surveys previously fixed.]

CENTRAL SUDAN. Captain J. Tilho's Explorations in and around Lake Chad, 1907-1908. 1:2,000,000=31.6 miles to an inch. 3 colors. With paper, "The French Mission to Lake Chad" by Capt. Tilho. *Geogr. Journ.*, vol. 36, p. 380, 1910. [Shows routes and many elevations in feet.]

TOGO. Die Togoküste 1895 und 1910. 6 maps on one sheet. Scales 1:2,000,000-1,000,000-250,000. By P. Langhans. With paper, same title and author. *Pet. Mitt.*, 56 Band, Heft VI, Tafel 57, 1910.

TROPICAL AFRICA. Die Verbreitung der Schlafkrankheit und der Tsetsefliegen im tropischen Afrika. 1:25,000,000=394.5 miles to an inch. 5 colors. *Pet. Mitt.*, 56 Jahrg. II Halbband, 2 Heft, Tafel 11, 1910. [Based upon the maps of the Sleeping Sickness Bureau, London, Oct., 1909.]

TUNIS-TRIPOLI. Das südtunesische Grenzland. Übersichtskarte zum französisch-türkischen Grenzstreit. 1:2,000,000=31.56 miles to an inch. 5 colors. With paper, "Das südtunesische Grenzland," by Lieut. Max Hübner. *Pet. Mitt.*, 56 Jahrg. II Halbband, 2 Heft, Tafel 19, 1910.

ASIA

ARABIA. Map of Oman. 1:2,000,000=31.56 miles to an inch. By Lieut.-Col. S. B. Miles. Inset of Arabia, 1:18,000,000. 3 colors. With paper, "On the border of the Great Desert: a Journey in Oman," by same author. *Geogr. Journ.*, vol. 36, p. 248, 1910. [From route traverses and other information.]

ASIA MINOR. Durchquerungen der Bithynischen Halbinsel. 1:300,000=4.73 miles to an inch. By Dr. W. Endriss. 8 colors and tints. 2 geological profiles. With paper, same author and title. *Pet. Mitt.*, 56 Jahrg., II Halbband, 4 Heft, Tafel 31, 1910. [Gives the results of geological surveys by the author and earlier explorers in the northwestern peninsula of Asia Minor.]

CHINA. Routes of the Imperial Russian Geographical Society's Expedition in Kan-su and Mongolia under the command of Col. P. K. Koslof. From a survey by Capt. Napalkof. 1:4,000,000=63.13 miles to an inch. 3 colors. With paper, "The Mongolia-Sze-chuan Expedition," by Col. Koslof. *Geogr. Journ.*, vol. 36, p. 380.

CHINA. Die südliche Mandschurei: Zum Verfolg der Operationen im russisch-japanischen Kriege. 1:2,000,000=31.56 miles to an inch. With paper "Die geogr. Gestaltung der Südmandschurei und ihr Einfluss auf die Operationen im russisch-japanischen Kriege. *Pet. Mitt.*, Vol. 55, No. 12, 1909.

CHINA. Prof. Dr. Karl Futterers Routenaufnahme von Mintschou bis Long-kü-tsai. 2 Sheets. 1:500,000=7.89 miles to an inch. With "Karl Futterers geologische Studien in Zentralasien," by Prof. L. v. Lóczy. *Pet. Mitt.*, Vol. 55, No. 12, 1909. [The work of the Holderer-Futterer expedition in 1898-9. The survey, mapped in colors here, was made Dec. 1-31, 1898. A carefully detailed route survey with large nomenclature.]

CHINA. Part of Southern Se-chuan (Lololand). 1:1,000,000=15.78 miles to an inch. By W. N. Fergusson. 3 colors. *Geogr. Journ.*, vol. 36, p. 512, 1910.

CHINA. Rundreise des Kaiserlich Deutschen Konsulatsverwesers von Chengtu-Chunking in Sze-chuan. Von Konsul Weiss. 1:500,000=7.89 miles to an inch.

Inset of his route from Chengtu in 1:3,000,000. With paper, "Reise durch die Eingeborenenstaaten in Westszetschuan, Sept.-Nov., 1908." *Pet. Mitt.*, 56 Jahrg., II Halbband, Tafel 12, 1910. [Gives new data for the mapping of this region.]

Dutch East Indies. Reisewege der Frankfurter Sunda-Expedition, 1909-10. (a) Reisewege auf Südost -Celebes. 1:2,000,000; (b) Reisewege auf Soembawa. 1:1,000,000. 3 colors. By Dr. J. Elbert. With paper, "Bericht über die Elbert-Sundaexpedition," by Dr. B. Hagen. *Pet. Mitt.*, 56 Band, Heft. VI, Tafel 52, 1910.

India. Explorations in the Eastern Karakoram. 1:500,000=7.89 miles to an inch By T. G. Longstaff. 4 colors. Illustrations 'Glacier Exploration in the Eastern—by same author. *Geogr. Journ.*, vol. 35, p. 744, 1910. [Map based on fixed points of the Survey of India.]

Siam-British Malay Peninsula. Le Chemin de Fer de Bangkok à la Malaisie britannique. No scale. Black. With paper, same title, *L'Asie Française*, No. 113, Aug., 1910. [Shows completed and unfinished parts of the R.R. line to connect Bangkok with Singapore.]

Siberia. Tiefenkarte des Baikal-Sees. 1:1,500,000=23.67 miles to an inch. 6 blue tints. 3 profiles. With paper, "Der Baikalsee" by Prof. Dr. A. Woeikow. *Pet. Mitt.*, 56 Band, Heft VI, Tafel 51, 1910. [From the Russian original which was based on the work of the Hydrographic Expedition to Lake Baikal in 1896-1902.]

EUROPE

Germany. Höhenschichtenkarte der Lüneburger Heide. 1:200,000=3.1 miles to an inch. Von Dr. Konr. Olbricht. Inset: Höhenlage der altdiluvialen Schichten in Meter. 1:750,000. 10 tints for contours of elevation. 4 profiles through the Heath. With paper, same title and author. *Pet. Mitt.*, 56 Jahrg., II Halbband, 3 Heft, Tafel 21, 1910.

Greece. Die Kykladeninsel Donusa. 1:75,000=1.18 mile to an inch. 6 colors and tints. With paper, "Zur Kenntniss der Kyklade Donusa." *Pet. Mitt.*, 56 Jahrg. II Halbband, 3 Heft., Tafel 26, 1910.

Iceland. (a) Der Langjökull auf Island. 1:600,000=9.4 miles to an inch. By Th. Thoroddsen. (b) Thórisdalus und Südrand des Langjökull. 1:300,000=4.73 miles to an inch. By L. Wunder. With paper, "Beobachtungen am Langjökull und im Thórisdalur auf Island," by Lieut. Wunder. *Pet. Mitt.*, 56 Jahrg., II Halbband, 3 Heft, Tafeln 22, 23, 1910. [Routes, glaciers, geology, etc., in colors.]

Macedonia. Die Oberfläche Mazedoniens. Skizze der Anordnung der Faltungsgürtel auf dem Rumpfe der Süd Ost Halbinsel. Nach Cvijic. No scale. Black. With paper, same title, by K. Oestreich. *Geogr. Zeits.* 16th Jahrg., 10th Heft, Tafel 8, Leipzig, 1910. [Black symbols show the geology and distribution of the surface forms.]

Montenegro. Die räumliche Entwicklung des Königreichs Montenegro. Nine maps on one sheet. 1:1,500,000=23.67 miles to an inch. Zusammengestellt von Paul Langhans. 5 colors. With paper, same title, by Prof. Dr. K. Hassert. *Pet. Mitt*, 56 Jahrg., II Halbband, 3 Heft, Tafel 20, 1910. [Shows the territorial extent of Montenegro about A.D. 1400 and in 1820, 1838, 1855, 1860, 1878 (before the peace of S. Stefano), 1878 (according to the Berlin treaty), 1880 and 1910 when, on Aug. 28, Montenegro became a kingdom.]

RUSSIA. Die Verbreitung der Hausgewerbe im Daghestan. 1:700,000=11 miles to an inch. By Dr. A. Dirr. 3 colors. With paper (same title and author) in *Pet. Mitt.*, 56 Band, Heft VI, Tafel 50, 1910.

SPAIN. Die Herdenwanderungen in Spanien. 1:3,700,000=58.3 miles to an inch. 5 colors. Nach A. Fribourg. With note, same title, by O. Quelle. *Pet. Mitt.*, 56 Jahrg., II Halbband, 2 Heft, Tafel 17, 1910. [The data are taken from 2 maps by Fribourg in *Ann. d. Géog.* (vol. xix, 1910), illustrating the movements of sheep in Spain between higher and lower altitudes, according to changes in pasturage as affected by climatic conditions.]

AUSTRALASIA AND OCEANIA

AUSTRALIA. Reduced Survey Map of Australia. Revised Edition. 1:6,000,000=94.6 miles to an inch. By J. G. Bartholomew. In colors. Insets of Melbourne, Sydney, Brisbane, Adelaide, Hobart and Perth on large scales. John Bartholomew & Co., Edinburgh, 1910. 2s. net. [An excellent map of the continent with large nomenclature produced in the best style of this map house. Each county in the several states is bounded and named, cable lines, telegraphs and steamer routes are given and the railroads are differentiated as in operation or in course of construction. The hill features are shown by hachures. The railroad from Port Augusta, which is to be carried west to Kalgoorlie, thus completing the east and west transcontinental line, is shown according to the survey of the Commission that has recently completed that work. The whole map is legible and the plans of the leading towns and ports add much to its value.]

AUSTRALIA. (a) Victoria. 1 inch=30 miles. Black; (b) Map of Queensland. 1 inch=75 miles. Colors. [Shows the railroads, towns and distribution of live stock]; (c) Map of Western Australia. 1 inch=90 miles. Colors. 1910. [Colors show lands held under pastoral leases and areas in which agricultural lands are open for selection. An inset shows prevailing varieties of trees in the timber areas]; (d) New South Wales. 1 inch=50 miles. Black. [Shows railroads and principal roads.] Illustrate "The Yearbook of Australia, 1910."

SOUTH AUSTRALIA. Map of the southern portion of Southern Australia. 1 inch=16 miles. In "The Year-Book of Australia, 1910."

NEW GUINEA. Versuch einer seismo-tektonischen Skizze des Schutzgebietes Deutsch-Neu-Guinea (Kaiser Wilhelms-Land und Bismarck-Archipel). 1:10,000,000=157.8 miles to an inch. By A. Sieberg. 16 colors and tints. With paper, "Die Erdbebentätigkeit in Deutsch-Neuguinea, same author. *Pet. Mitt.*, 56 Jahrg., II Halbband, Tafel 15, 1910. [Shows observation stations, volcanoes, volcanic line, earthquake areas differentiated as to relative intensity of shocks, and 10 tints indicate sea depths.]

NEW GUINEA. Küste des Kaiser Wilhelmlandes von Eitapé bis Aróp. 1:100,000=1.5 mile to an inch. 5 colors. With paper, "III. Zur Kenntniss des Kaiser-Wilhelms-Landes und einiger Neuguinea und Neupommern vorgelagerten Inseln," the conclusion of Prof. Dr. Karl Sapper's papers on the explorations of Dr. G. Friederici. *Pet. Mitt.*, 56 Band. Heft V, Tafel 44, 1910. [Shows Friederici's route along the coast with many place names he obtained.]

NEW GUINEA. KAISER WILHELMSLAND. (a) Reise von Eitapé längs der Küste nach Hollandia. Aufgenommen von Dr. G. Friederici, Dezember, 1909; gezeichnet von Prof. Dr. K. Sapper. 1:300,000=4.73 miles to an inch. 4 colors. Inset: Skizze des Pfahldorfes Leitere im Barai. 1:20,000. [A survey of the extreme western part of the northern coast of Kaiser Wilhelmsland]; (b) Reise

in das Hinterland von Eitapé. By Dr. G. Friederici. 1:50,000=0.79 mile to an inch. 4 colors. With paper, "In das Hinterland der Nordküste des Kaiser Wilhelmslandes (Neuguinea)" by Dr. Friederici. *Pet. Mitt.*, 56 Jahrgang, II Halbband, 4 Heft, Tafeln 34, 35, 1910.

SAMOA. Regenkarten von Deutsch-Samoa. 1:500,000=7.89 miles to an inch. 2 colors. With paper, same title, by Dr F. Linke. *Pet. Mitt.*, 56 Jahrg., II Halbband, 3 Heft, Tafel 24, 1910. [Three maps with isohyetal curves showing rainfall in centimeters for year, January and July.]

INDIAN OCEAN. Chart to illustrate a paper on Aldabra and neighboring Islands. 1:5,000,000=78.9 miles to an inch. Insets of Aldabra, Assumption, Astove Is. and Cosmoledo Group in 1:250,000. By J. C. F. Fryer. Black. With paper, "The South West Indian Ocean" by same author. *Geogr. Journ.* Vol. 36, p. 380, 1910. [Many soundings in fathoms and qualities of sea floor indicated.]

POLAR

SOUTH WEST GREENLAND. (a) Jakobshavner Eisfjord und Tasiussak, 1:150,-000; (b) Torsukatak und Ikarasak, 1:225,000. Mit benutzung von älterer Karten aufgenommen 1902-1904 von Dr. M. C. Engell. 3 colors. With paper, "Zur Kenntniss der Fjorde Grönlands," by Dr. Engell. *Pet. Mitt.*, 56 Band, Heft VI, Tafel 54, 1910.

ARCTIC REGIONS. Sketch Map to illustrate the Expedition of Comm. R. E. Peary, U. S. N., 1908-1909. 1:25,000,000=394.5 miles to an inch. 3 colors. With profile of soundings from Cape Columbia to the Pole. Illustrates paper, "Peary Arctic Club Expedition to the North Pole, 1908-09" by Comm. Peary. *Geogr. Journ.*, vol. 36, p. 248, 1910. [The map makes the northern and southern routes of Peary, to and from the Pole, as identical, which, according to his report, is practically correct, though the map in his book shows them as diverging from the Pole southward.]

OTHER ACCESSIONS

NORTH AMERICA

ABBOTT, JOHN S. C. South and North; or, Impressions Received during a Trip to Cuba and the South. New-York, Abbey & Abbot. 1860. 12mo.

DELLENBAUGH, FREDERICK S. Breaking the Wilderness. The Story of the Conquest of the Far West, etc. (Maps, etc.) New York, G. P. Putnam's Sons. 1908. 8vo. *Gift.*

DIAZ, DEL CASTILLO, BERNAL. The True History of the Conquest of New Spain. Vol. III. By——, one of its Conquerors. *From the only exact copy made of the Original Manuscript.* Edited and published in Mexico, by Genaro García. Translated into English, . . . by Alfred Percival Maudslay. [Pamphlet and 12 Maps in case.] The Hakluyt Society, Second Series. No. XXV. London. 1910. 8vo.

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THE FIRST ASCENT OF MOUNT OLYMPUS

BY

BELMORE BROWNE

In the center of one of the most beautiful stretches of wilderness country in the West, the Olympic Mountains of Washington, stands Mount Olympus, the highest peak of the range.

Mount Olympus was named El Cero de la Santa Rosalia by the Portuguese, and later the Spaniards referred to it as La Sierra de Santa Rosalia. Captain Mears saw the mountain in 1788 and named it Mount Olympus, which name was adopted by Vancouver in 1792.

The Olympic Mountains lie in a great broken mass of knife-like peaks in the center of the Olympic Peninsula, which separates Puget Sound from the Pacific Ocean. They do not rise to a great height above the sea, but their formation is of such ruggedness that, even with the commerce of the Pacific and growing cities encircling their foothills, they have remained practically unexplored.

While it is true that most of the main ranges and water systems have been followed by adventurous hunters or travelers, the scientific exploration of this wilderness is still an unwritten story and few of the maps of the interior are trustworthy except in the broadest sense. This fact was due to the supposed lack of minerals in the mountains, and to the wonderful growth of forests that bury the foothills in an almost impenetrable tangle of vegetation.

The Alaskan coast range is not more difficult to penetrate than these forest darkened crags. It is the land of the "devil's club" and "down-timber," where the explorer at times can barely chop his way through the matted underbrush; of knife-like ridges and deep cañons,

where the roaring of glacier rivers disturbs the silence as they twist and plunge on their way to the sea.

The moist, westerly winds, coming in from the Pacific, precipitate this moisture on striking the upper snowfields, and bathe the lowlands for many months in the year with fogs and showers. These conditions make pack-train travel impossible except where trails have been cut towards the interior. In the work of exploration the traveler must eventually fall back on the pack-strap, which necessarily limits him to a light outfit.

It is needless to give a detailed account of our travels before reaching the mountain; suffice it to say that every moment was a lasting joy, and the beauties of mountains and forests a never-failing source of wonder. From the days when we traveled among mighty cedars where the gloom and silence could be likened only to that of some great cathedral, to the time we spent following up the crystal rivers where our shouts were lost in the roaring of the waterfalls, we were surrounded by natural beauties that are nowhere excelled.

Our party consisted of Prof. Herschel C. Parker, Walter G. Clark and the writer. At Port Angeles we secured the services of Henry Sisson and his pack train, and in Geyser Valley we were joined by William Humes. Roughly, our route began at Port Angeles on the Strait of Juan de Fuca and followed the valley of the Elwha river due south into the Olympic wilderness.

We were forced to leave our horses at the head of the Elwha River. A long snow-filled gully led us with our back loads of food and mountain necessities across the range to the head-waters of the Queets River. We named this pass after Dodwell and Rickson of the U. S. Geological Survey, who were the first men known to have crossed it. From the top of this pass you can, on a clear day, see Mount Olympus rising above some jagged intervening peaks to the westward.

We descended into the timber in the Queets valley, and pitched our camp in a position where we could get an unobstructed view of the eastern ridges of the Olympus foothills. Directly in front of our camp was a large glacier that came from a high rock-ridge which shut off the view of the big mountain. This glacier, which we later named the Humes glacier, was evidently the key to the climbing situation.

Next morning the rising sun found us moving towards this great mass of ice. Within a quarter of a mile of the frontal moraine we came to a cañon wall which delayed us so long that we were forced to put off the final attempt on Mount Olympus until the following

day. The main party then returned to camp. Humes went down the cañon to reconnoiter the south side of the glacier, and I climbed up the cañon on a reconnaissance of the north side. Mount Olympus was about five miles away and lay about N. W. by W. from our camp.

Between us and the summit was the high ridge which might prove a serious barrier. This ridge was in turn partly hidden by a

FIG. 1—Agnes Falls, Head of Queets River. Photo by Belmore Browne.

high cliff, around which the Humes glacier swept in the form of a great roadway of ice. I, therefore, devoted my attention to finding a good route to the top of the glacier, and let our other troubles wait until they confronted us. My first attempt to climb the ice was by the side of a wedge of rock several hundred feet high that split the glacier into two streams, and formed a large serac. The climbing was very rough but safe, and all seemed well until I found that the ice on the serac was breaking constantly and was liable to avalanche.

The danger turned me to the north wall, and an hour later, after traversing some cliffs, I gained the top of the glacier and found an unobstructed route to the dividing ridge. I could not tell from my position whether or not the ridge was a serious obstacle, but it appeared to be easy on the northern end, so I cut three steps in the green ice, for luck, and started campward. On my return I found a camp site much nearer the glacier, and that same day we moved our camp to the foot of the ice wall, and prepared for our final attempt.

Our climbing began at dawn the following morning, and 200 yards from camp we made a traverse at the base of a cliff where we put on the rope and settled down to work. Below the cliff we swung wide, as some rocks were falling. We scaled the serac easily, our axes ringing clear on the green ice, and beyond we could see our majestic glacial roadway sweeping gently to the big dividing ridge. The sun had risen in a sky of metallic brilliancy, and it already beat down on the snowfield with such fierceness that even through our smoked glasses the glare was painful.

A long, steady tramp brought us to the cliff that had masked the dividing ridge, and we saw above us a saddle that was not difficult to reach; a little step-cutting brought us to the top, and as our heads rose above the ridge a wonderful mountain panorama came into view.

Directly below us lay a large glacier that we knew must be one of the feeders of the Hoh River that flows into the Pacific Ocean; and beyond, towering high above us, stood Olympus—a jagged peak of rock rising from a long ridge-like base of snow. We named the pass we had just crossed, Explorers' Pass, after a club of which we were members. The descent to the floor of the Hoh glacier was accomplished quickly and we began a long tramp to a high ridge that swept in a curve to the base of the final peak. We were now traveling nearly south, our course since early morning having been a series of long zigzags between mountain ranges, using glaciers as roadways. There were many crevasses, but we made good time across the blinding snow. Now and then we would jump one of the

smaller cracks, and catch glimpses of dark-green caverns that looked temptingly cool in contrast with the glare about us. The few patches of rock we passed were a pleasant relief to our eyes.

From the first step on the Humes glacier to the "bergshrund" just below the summit was a continuous snow and ice climb, and it was with the greatest mental enjoyment that we reached the narrow ridge of rock that lay below our goal. This ridge was due east of Mount Olympus; it sloped gently down on the north side to the big glacier that feeds the Hoh River, but on the south side it fell off in a precipice. To the south we could see a fine Alpine glacier that flowed parallel to and to the westward of the Queets River.

FIG. 2—Dodwell-Rickson Pass, showing headwaters of Elwha River. Photo by Belmore Browne.

Mount Olympus itself is a high ridge, steep on the south side and sloping on the north, that rises from a system of ridges extending from the valley of the Queets River to a point about ten miles to the westward. At intervals there are peaks and spurs, and the main pinnacle rises at the head of three great glaciers that feed the Hoh River, which in turn lies at the northern base of Olympus and flows westward to the Pacific Ocean. The main peak is held up by three smaller peaks that rise in regular order from the Hoh glacier. To the westward of Olympus the main ridge rises into a single pinnacle of rock, that, while it is an off-shoot from the Olympus ridge, appears to be nearly as high as Olympus. We called the western peak, Olympic Peak.

We stopped for luncheon on the narrow ridge below Olympus. A cool breeze from the south swept gently past, and before long we

were glad to crouch among the sun-warmed rocks for warmth. If Gods there were on the Olympus of the Ancients, we envied them not! A lump of pemmican, a handful of zwieback, and a teapot singing beside us in the wilderness—that certainly were Paradise enough!

Before attacking the last peak Prof. Parker took a hypsometer reading as a check on our aneroid. Again we chopped and kicked steps in ice and snow, until we reached a "bergshrund" that led us to a fine "couloir" below the last rock wall. This piece of rock climbing was the most interesting work that Olympus gave us. Below the chimney, a man, once started, would have dropped a long way to the glacier below, and above were loose piles of rock that made careful climbing necessary. At last I reached a small platform and on raising my head saw that we had reached the top. My last recollection of Olympus will be of looking down on the four men below, and again, so far beneath them that the crevasses looked like fine pencil marks—the great glaciers of the Hoh gleaming in the sunlight.

After an examination of the narrow ledge that was the goal we had come so far to reach, we turned our attention to the really wonderful mountain panorama that lay around us. Our chief interest centered in the topographical features of the immediate vicinity of Mount Olympus. To the westward beyond Olympic Peak, scarcely discernible through the haze of distance, lay the Pacific Ocean. To the eastward we could feast our eyes on a veritable sea of peaks, that seemed in their rough contours and gleaming snowfields to rival even the Alaskan range in grandeur. At intervals great lines of clouds passed slowly between the peaks as if they were following well-known trails. From the northern and northwestern sides of Olympus three large glaciers descended to the valley of the Hoh River. To the southward lay a fine Alpine glacier which, like all the other Olympus glaciers, discharges its ice water into the Pacific Ocean.

While our party was not equipped for making accurate maps of the region, we cleared up the doubts existing concerning this part of the Olympic Range. Instead of the fifty glaciers said to lie in the neighborhood of Mount Olympus, we saw seven in all, five of which came from the main ridge of the mountain.

Many remarkable stories have been told concerning the wonders to be found around the slopes of the mountains, and several claims to first ascents have been made. Only one of these, however, bears the brand of sincerity—the account of a first ascent by B. J. Brether-

ton and party—but in the light of the latest explorations, the account places this party in a different part of the Olympic Range, and in connection with the actual topography the report is unintelligible.

The Olympic mountains are destined to become one of the greatest American playgrounds. Nowhere can more natural beauties be found than among their rugged peaks. Every stream holds treasures of the finny tribe. Salmon and trout of several varieties abound, and in no other region does that prince of game fish—the rainbow trout—grow larger, or fight more fiercely. Big game is

FIG. 3—Party on Summit of Mt. Olympus. From left to right, Clark, Lisson, Browne, Parker. Photo by William Humes.

still plentiful, and with careful supervision the hills from the snow-line to the river bottoms could be made to resemble a zoological park. Unfortunately, there are no wild sheep or goats in the Olympic mountains. It is doubtful if sheep would live there, on account of the low altitude and humidity of the mountain pastures, but it is unquestionably true that if Rocky Mountain goats were liberated in the Olympic mountains they would thrive and would be a valuable addition to the wild life of this region.

ALASKA AGRICULTURAL POSSIBILITIES*

BY

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While en route to Alaska last summer, on the steamer Northwestern, the wireless telegraph operator added to the pleasure of the trip by issuing daily a little type-written bulletin containing Associated Press despatches and aboard-ship news. By way of diversion, some imaginative person on board would prepare for the daily *Aerogram* items of purported information as to the personality and business of certain passengers.

It being known by some on board that I was on my way to Alaska to study the agricultural characteristics and possibilities of the territory, I was regarded as a legitimate target for some of the good-natured fun shafts; and so in one issue of the *Aerogram* it was solemnly stated that my mission to Alaska was to establish government farms on which to grow bananas for brown bears.

But the joke was not all a joke, for it illustrated two facts. One is that it was fairly indicative of the prevalent knowledge regarding Alaska agricultural possibilities, and the other, that as yet Alaska farming is, in the public mind, more a matter of joke than for serious consideration.

How derisively did the American public receive the purchase by the United States of Alaska from Russia in 1867, and forthwith the territory was dubbed "Seward's Folly" and "Seward's Ice-box," in criticism of Secretary of State Seward's statesmanship in buying for $7,200,000 what was thought to be a worthless, uninhabitable region of perpetual ice and snow.

But we have become much better informed, in some respects, regarding this area of nearly 600,000 square miles; and, for the most part, the citizens of the United States are now convinced that, from a monetary point of view, the purchase of Alaska was a very profitable real estate deal. Official reports tell us that during the last 30 years the value of Alaska products total $335,000,000; that since 1880 there have been added $142,000,000 to the world's supply of gold

* By the courtesy of The Colorado Scientific Society, reprinted from its *Proceedings* (Vol. ix, 1910, pp. 387-402).

and the annual output is now about $20,000,000 from that source, and that the value of Alaska fisheries products is more than $10,-000,000 annually. And recent investigations by the Bureau of Geology are revealing fabulous wealth in coal, copper and other minerals. In one copper mine, the famous Bonanza mine, there is said to be $20,000,000 worth of high grade ore in sight, and numerous other rich prospects in the same field. Coal has been found in large quantities and in many districts. In only two fields, the Bering River and Matanuska, both near the south coast, it is asserted that,

FIG. 1—Shaded Areas indicate the Coal Deposits of Alaska.

so far as examined, there is more than one and a half times as much high grade coal as has thus far been mined in Pennsylvania.

"Yes, but farming is a different proposition; it must have suitable soil and climate, and these can't be found in an Arctic mountain region of ice and snow. It is foolish to talk about farming in Alaska, or are you just joking?"

Says the average American:

"Do not hundreds of our people visit Alaska every summer, and tell us and show us pictures of the vast snow-covered mountain ranges, and glaciers that come down to the sea, and the icebergs that often imperil the ships? These things they have seen with their own eyes, and therefore know that farming in Alaska is out of the question."

And looking at the matter from the view point of the average Alaska tourist, there surely are very meager agricultural opportunities in sight.

Let us take the usual Alaska tourist trip, and a delightful one it is, too, of a thousand miles via the Inside Passage from Seattle to Skagway, the terminus of the White Pass Railroad.

After passing out of Puget Sound and crossing the Straits of Juan de Fuca, our steamer will follow the channel between Vancouver and Queen Charlotte Islands and the mainland, and the labyrinthian passage of the Alexander Archipelago, which has been denominated the "Grand Canyon of the Pacific." And very canyon-like it is much of the way, for the passage, in reality, is through the coast range of mountains which here has its very feet in the Pacific. Day after day the steamer winds its way through the channels and fiords, sometimes so narrow as to seem scarcely to afford room for the ship to pass, shut in by the precipitous slopes of mountains on either hand, fir-clad to the water's edge, and always with snow, even in mid-summer, in sight, and this often apparently within a stone's throw of the ship. When the channel widens and distant views are had, they are of snow-clad mountain scenes, with peaks reaching 10,000 feet and more above sea-level. No level shore or back country areas suitable in topography for agriculture are seen, even if those snow fields were not so ominously near at hand. As we proceed northward and see plainly that the snow areas are increasing in size, we are not surprised, for are we not traveling toward the Arctic regions?

When we have passed from British waters and reached the southern point of Alaska, at latitude 50° 40′, we are 1,000 miles north of the parallel of Denver, Colorado; St. Joseph, Mo.; Springfield, Ill., and Philadelphia, nearly 400 miles north of Quebec, Canada, and within about 800 miles of the Arctic Circle. Juneau is still 200 miles to the north of us, but we can see, mentally and physically, that we are getting into "Seward's Ice-box," and, consequently, we begin to feel its chill.

If our steamer is an excursion boat, the captain will probably swing out of the regular course and soon the word glacier! runs tingling through the ship, and all on board are gazing intently at what has always been in our minds the dominant Alaska fact.

As we approach Juneau the glaciers increase in extent and frequency. If the excursion continues westward along the south coast, on leaving Juneau we pass into Icy Strait, a suggestively cold but fitting nomenclature, for here we will probably see icebergs

floating out of Glacier Bay from Muir, John Hopkins, and Brady Glaciers, all forming one of the largest glacier fields in the world, mothered by Mount Fairweather, rising 15,363 feet above the sea.

It was in Icy Strait that the steamship Yucatan, of the Alaska Steamship Company line, was wrecked recently by striking an iceberg.

Passing out of Icy Strait through Cross Sound into the open sea, we follow the shore line westward a thousand miles to Seward, with snow-covered mountains and glaciers almost continually in sight.

FIG. 2—Shaded Areas indicate the Copper Regions of Alaska.

About half way between Juneau and Seward we will pass the great Malaspina Glacier, thousands of square miles in extent, fronting the sea. This ice field lies upon the breasts of the St. Elias Range, and if the weather is clear there will be revealed one of the most magnificent scenes ever looked upon by mortal eyes. Mt. St. Elias, rising apparently from the water's edge, lifts its head 18,026 feet above the waves, and is backed by Mt. Logan and Mt. Irving, each more than 19,000 feet high, with numerous peaks rising above 14,000.

While under the spell of the sight of the apparently illimitable fields of ice and overpowering mountain masses fronting this shore

of Alaska, we are reminded that it was in this vicinity, on July 16, 1741, that the Danish navigator, Vitus Bering, in the employ of Peter the Great, first sighted Alaska; and we cannot help but wonder what must have been his speculations as to the character of the land that presented so chilling and forbidding an aspect from this, its southern shore, at that season of the year.

Proceeding to the end of the run at Seward, calling on the way at Valdez, the "Glacier City," perhaps going out to the glacier four miles back, on the moraine of which the town is built, we return from our trip to Alaska impressed by the fact that in daylight and clear weather we were never out of sight of snow-covered mountains.

We have passed en route numerous salmon canneries, which have given us a glimpse of the Alaska fisheries industry; we saw the great Treadwell gold mine at Douglas, opposite Juneau, that turns out $3,000,000 in gold annually; we heard much of the rich placer gold diggings at Nome and in the Fairbanks country, and of the fabulously rich copper mines to which a railroad 200 miles in length is being built at a cost of $20,000,000, and we know of the extensive coal deposits, controversy regarding which is exciting much interest. And learning, too, something of the high cost of food and forage in the interior mining camps, we think of the advantage it would be to these interests if they could be supplemented by a farming industry that would provide a cheaper home supply of food for men and teams; but from what we have seen on a 2,000-mile voyage along the southeastern and southern coast of Alaska, we are ready to admit that farming in Alaska is a very meager possibility.

But perhaps the impression that we got of Alaska from looking at the cold and forbidding face she turned toward us while on the excursion steamer is not wholly warranted. Did you ever know of a person who was regarded by those with whom he came in casual contact as being cold, but who to his intimates was known to be warm hearted and genial? There are many such people, and Alaska is like unto them. She will yet surprise the world in her manifestation of good will toward those who become acquainted with her, and in no way more than in the food she will afford her children from her own bosom.

What has given the world, from Bering's time till now, its most vivid impression of Alaska? The mountain system that fronts the southern shore, the natural point of approach to Alaska.

This system is the continuation and culmination of our Coast Range. Extending northward, the mountains press so close to the sea that our course to Alaska, as we have seen, lies through their

very canyons. In Alaskan physical geography, this is the Pacific Mountain System, and comprises a number of more or less distinct ranges. The St. Elias Range, the Chugach and the Kenai Mountains stand close to and follow the great curve of the south Alaska shore from the east westward, while just back of these are the Nutzotin Mountains and the Alaska Range, all forming the arc of a great circle. The ranges merge more or less at the eastern ends, but farther westward they become more distinct one from the other, so much so that the western ends are separated by the Susitna River and Cook Inlet.

At the eastern end of this Pacific Mountain System stands the St. Elias group of peaks reaching altitudes of 19,000 feet. Continuing west, with its sweep to the north then southward, the altitudes are 14,000 to 16,000 feet, until the ultimate height is reached at 20,300 feet in Mt. McKinley.

This Pacific Mountain System lies within a radius of 200 miles of tide water on the south shore of Alaska. It comprises less than one-fifth of the total area of the territory, but it is a dominating fact by virtue of its position and altitude. When the warm and moisture-laden air currents from the Pacific are obstructed in their northern course by this elevated, cold, snow-covered land mass, their moisture is squeezed from them as snow, to be added to the accumulations of ages, and form the Alaskan snow and ice-fields with which we are so familiar. But right here, in the Pacific Mountain System, is practically all of the permanent snow and ice field of Alaska. Remarkable as the statement may appear to be, nevertheless the geographers tell us that the Arctic Mountain System of Alaska, which lies wholly north of the Arctic Circle, has a very limited permanent snow and ice area. This is owing to the much lower altitude of that system—hardly reaching 5,000 feet—and the drier atmosphere.

Lying between the two principal mountain systems of Alaska, the Arctic System, fronting the Arctic Ocean, and the vastly higher and more massive Pacific System that stands guard against the south Alaska shore, is a great interior plateau. Extending from the Alaska-Canadian boundary 600 miles west to the Pacific Ocean, it has a width north and south in the eastern portion of 300 miles, but as it extends towards the ocean, and the Alaska Range of the Pacific Mountain System sweeps southward out on the Alaska Peninsula, it spreads out into the rolling moss-covered tundra that comprises the major portion of the west half of Alaska.

Through this great interior plateau flows the Yukon, one of the

great rivers of the world. Its waters are navigable for a thousand miles from its mouth to the Alaska-Canadian boundary and for five hundred miles farther within British territory, and its main affluent the Tanana, gives to this region 300 miles more of inland water way in the heart of Alaska.

In the eastern portion of this interior plateau are the Alaska agricultural possibilities of greatest moment as to extent and availability—a region comprising 100,000 square miles lying between the Alaska-Canadian boundary on the east, the Endicott Range of the

Fig. 3—W. A. McPherson's Ranch, near Seward, Alaska.

Arctic Mountain System to the north, the Pacific Mountain System lying south, and the open tundra country of western Alaska.

This region is not for a moment to be compared as to topography and arable character with our Great Plains or Mississippi Drainage areas; nevertheless, it is beyond question that there are many thousands of acres among its millions that can and will be utilized for tillage, with thousands more available for grazing.

The great variety of vegetation, including wide reaches of luxuriant growths of native grasses, and wild fruits, delicious in quality and abundant in quantity, is Nature's evidence to us that farming in this region is practicable so far as this depends on climate and

soil; and the United States agricultural experiment stations at Fairbanks, on the Tanana, and Rampart, on the Yukon (this latter station is within 75 miles of the Arctic Circle) together with numerous individual gardens and ranches of homesteaders, and mission station gardens scattered along the one thousand miles of the Yukon and Tanana Rivers, supplement and conform what nature tells us.

Potatoes, turnips, carrots, cabbages, cauliflower, radishes, lettuce,

FIG. 4—Wild Grass, Seward, Alaska.

peas—all the hardy vegetables—cultivated grasses and small grains for stock forage can be raised in abundance, and at the Rampart Experiment Station wheat, oats and barley are being ripened. Some of the hardiest varieties of vegetables are grown in picked localities north of the Arctic Circle, almost to the Arctic Ocean.

That the Tanana and Upper Yukon Valleys will, at no very distant day, have a farming population outnumbering the present white population, about 35,000, of Alaska, and will be producing from the soil a large part of the food supply of a greatly increased mining

population, admits of little doubt. The number of homesteaders in this region, and what they are accomplishing, are sufficient proof of the feasibility of farming in Alaska.

All the possibilities for agricultural development are by no means to be found in the interior plateau.

With the mountains pressing so close to the sea, the percentage of arable land on the south shore is necessarily very small; but along this 3,000—mile shore line there are a good many hundred acres of available tillable land, mostly in small areas. At all of the Seattle steamer ports, from Ketchikan in southeast Alaska to Port Graham on Cook Inlet, one will find gardens with a wide assortment of vegetables and cultivated flowers growing.

At Seward, the southern terminus of the Alaska Central Railway, there are a number of 320-acre homesteads, and land available near the town and along the line of the road for more. When the construction of this road has been pushed around the Turnagain and Knik Arms of Cook Inlet to the Matanuska coal fields, and up the Susitna River, it will make accessible many thousand square miles of promising farming lands. In the Cook Inlet region, including the Susitna Drainage, there is room and a growing demand for a large farming industry as an adjunct to an expanding mining industry. With the opening up of the Matanuska coal fields, this demand will be urgent.

The Copper River and Northwestern Railroad, starting from Cordova as its tidewater terminus, reaches, at the mouth of the Chitina, about one hundred miles from the coast, a considerable body of tillage land.

In the Copper River Drainage above the mouth of the Chitina, are other areas of land on which farming is feasible. In this drainage area is land within 200 miles of the south coast that will be made accessible by the Copper River and Northwestern Railroad, already practically completed to the mouth of the Chitina, sufficient for a farming population equal to one-tenth the total present white population of Alaska. This road will also tap the Bering River coal field, which, together with the copper and other mines, will necessitate a large population for their development, and which will afford a market for products of the farm and garden.

Besides the areas mentioned, where there are agricultural possibilities and the promise of a consuming market near at hand, there are, unquestionably, other large areas of land that might be cultivated, but with no consuming population within reach at present.

Such areas probably exist in the little explored Kuskokwim River Drainage lying to the west of the Alaska Range.

A large stock raising industry is feasible on the grass-covered lands of the Alaska Peninsula and adjacent islands, as is being demonstrated by the Government Experiment Station at Kodiak, while the thousands of square miles of luxuriant native grasses on the main land give promise of an extensive grazing interest—this in addition to a reindeer industry in the exposed and moss-covered region of Western Alaska, which may ultimately number millions of reindeer.

Dependent as it is upon climate, as much as upon soil, let us consider somewhat the suitability of Alaskan climatic conditions for farming.

FIG. 5—A Potato Patch, Knik, Alaska.

It should not be forgotten, in this connection, that we are considering a territory that has a latitudinal range of 1,000 miles and an altitudinal range from sea level to 20,300 feet above; that the south, west and north sides of the area are ocean fronts, each differently affected by the contiguous body of water; that the geographical position, topographical features, air currents and ocean currents have very marked climatic effects, resulting in great variation of climate.

The almost continuous range of mountains, that follows so closely the south shore, has a profound effect on the climate, not only of the

coast region but the interior, This lofty, snow-capped range receives upon its cold breasts the moisture-laden air currents from the ocean, and compels them to precipitate a large part of the moisture before going on to the interior.

It is rather startling to learn that Sitka, in latitude 57°, has a mean annual temperature not very different from that of Washington, D. C., in latitude 39°; that while the summers of Sitka are cooler than those at Washington, the winters are not so cold. Zero weather is seldom experienced at Sitka and the maximum summer temperature is rarely above 85° F. The average annual precipitation at Sitka is 90 inches. Similar weather conditions prevail throughout southeastern Alaska. Going northward and westward along the coast, both the average temperature and precipitation decrease. Kodiak and Afognak Islands, in Southwestern Alaska, have an even climate as to temperature, but much less rainfall—50 to 60 inches annually—than in Southeastern Alaska. On the Kenai Peninsula, in the Cook Inlet region, the range of temperature is much greater—from a maximum of nearly 90° F. to 40° below zero—while the average annual rainfall may not be over 30 inches.

The season between frosts on the south coast may range from 200 days in Southeastern Alaska to 90 days in the Cook Inlet region.

In the great interior plateau there is, to begin with, a much drier climate—from 10 to 20 inches of annual rainfall—because of the effect of the mountains lying between it and the ocean. Cut off from the temperature-modifying influence of the ocean, the changes from winter to summer, and vice versa, come more quickly than on the coast, and the range of temperatures is much greater. The summers are short but quite warm, the thermometer sometimes registering close to 100° F. The winters are long and severe, with minimum temperatures of 60° to 80° below zero.

The growing season is from 60 to 120 days. This is, apparently, a very short season, yet much longer than it seems, because of the number of hours of daily sunshine during that part of the year in this latitude. Under the effects of the almost continuous sunlight, there is a remarkably rapid and luxuriant growth of vegetation, a fact that must be given much weight in considering the agricultural possibilities of Alaska.

From what has been said in the foregoing it must not be inferred that farming in Alaska is "as easy as falling off a log," and farmers should not "tumble over themselves" to get there. It is to be remembered, in the first place, that, so far as there are means of transportation, the rates, passenger and freight, under existing conditions,

are necessarily high. Lack of roads and the nature of the country make summer travel, other than on foot, almost an impossibility. Where the land is level it is, for the most part, covered with moss, grass, brush, and trees, and is a quagmire from the melted snow and frost of the surface soil.

This limitation on summer travel is indicative of the difficulty that confronts one when attempting to open up a farm. The arable land must, for the most part, be cleared of timber, heavy on the south coast, thin and scrubby in the interior, and stripped of a thick coat of moss which is a very excellent non-conductor of heat. Not until this latter is removed will the heat of the sun penetrate the soil and lower the frost line sufficient for tillage crops.

Prof. C. C. Georgeson, Special Agent in charge of U. S. Agricultural Experiment Stations in Alaska, in a bulletin on Vegetable Growing in Alaska, says:

"At all places in the interior the ground is frozen to an unknown depth. In the spruce thickets at Fort Yukon (on the Arctic Circle) the writer has found ice immediately under the surface coating of moss in the month of July; but where the surface was exposed to the full effect of the sun, the ground having been cleared and then covered with grass, it has thawed out to a depth of between two and three feet. It is found that when the ground is cleared and the dark, bare earth exposed to the sun, the line of perpetual ice gradually sinks deeper and deeper. At Holy Cross Mission (on the lower Yukon, latitude 62°) in digging a well in such ground to a depth of 24 feet no ice was found. As far as vegetable and grain growing is concerned, the ice is not a drawback after it reaches two or three feet. On the contrary, as it slowly melts from the heat above, it furnishes moisture to the growing plants, and in dry seasons is thus a substitute for irrigation."

The soil in its natural state is, generally speaking, wet, cold and sour. The short season of high temperatures does not give time enough for the melting of the snow and frozen ground, the drying of the latter and the absorption of sufficient heat to cause a rapid decay of vegetable matter. The result is an accumulation of partially decayed vegetation, which has great moisture-holding capacity and low conductibility, and thus the direct climatic effect on the soil is intensified. This wet and cold condition of the soil and consequent slow and imperfect decay of vegetation results in a pronounced acidity.

Clearing the land of the protecting vegetation and thus allowing the sun and air to reach the soil, and providing drainage, will lower the frost line in the soil, remove the excess of moisture, raise the temperature, and correct the acidity. This last can be hastened by the application of lime to the soil.

But all this involves much labor and heavy expense under present conditions in Alaska. As these are now, a man with a family and limited means would not be justified in attempting to go to Alaska to establish a farm home.

Undoubtedly these conditions will speedily change. Train service this season on the Copper River and Northwestern Railroad from Cordova, on the south coast, to the mouth of the Chitina, making accessible tillage and mines in the Copper River Drainage, and with the pushing of the Alaska Central Railroad from Seward into the Su-

FIG. 6—Wild Red Top Grass, near Seward, Alaska.

sitna Drainage, above Cook Inlet, which will open up another great area in which there are both mining and agricultural opportunities, will mark a new era in Alaskan development. And unquestionably one or both of these roads will be speedily pushed on to the Tanana, when the great interior will be accessible by two steamer routes during the summer—one via Skagway down the Yukon, the other via Nome up the Yukon and Tanana—and by one or more railroads from the coast ports which will afford all-the-year service. When this is accomplished Alaskan development will be rapid and marvelous.

The paramount interest of Alaska is mining, and it will probably

continue to be. It is this interest that has the attention of the great majority of the 35,000 white residents of Alaska. But, although statistics show values of annual products aggregating millions of dollars, it is the well substantiated belief of experts that Alaska's mineral wealth has only been scratched.

Enormous development of mining awaits two very necessary adjuncts, namely, transportation facilities and a farming industry.

While Alaska is unusually well supplied with navigable streams, on nearly all of which steam or gasoline boats ply during the summer, yet there are vast stretches of back country in which there is untold mineral wealth, but which can only be reached with dog sledges in winter on the snow, or by "mushing" on foot in summer, with one's pack on one's back, accompanied, in rare instances, by a pack horse with a hundred pounds of provisions.

Napoleon said, "An army moves on its belly," meaning of course, that it is helpless without its commissariat. The mining industry of Alaska, and, for that matter, any other industry in any other country, is dependent upon an adequate food supply. When one realizes that, heretofore, the large proportion of the food supplies consumed in Alaska have been shipped from San Francisco to Nome, 2,700 miles, or from Seattle to South Alaska ports, from 1,000 to 2,000 miles distant, then transported by river steamers, winter sledges or pack trains a thousand miles or more to interior points, the freight charges sometimes reaching to 50 cents and more a pound, one can understand why food—potatoes, onions, flour, etc.,—sometimes costs the miner at some of the interior camps $1 a pound, and horse feed quite as much.

My last summer's Alaska trip was by steamer from Seattle to Port Graham, at the mouth of Cook Inlet, then by an Inlet steamer to the mouth of Susitna River, and up the river on a stern-wheeler 75 miles. At Susitna Station I met the manager for the Alaska Commercial Company, who had just returned from Valdez Creek, a new gold placer camp 100 miles farther up the stream and above steamer navigation. He told me that while at the camp he had sold potatoes, flour and other such articles over the counter at $1 per pound, and that hay and grain brought from $800 to $1,000 a ton. And in that region are thousands of acres of land on which native red top grass grows five feet high, and which would make a ton and more of good hay per acre. The land would grow potatoes, turnips and other vegetables in abundance.

A few weeks later, going up the Copper and Chitina Rivers to the Bonanza Copper mine, I found the Kennicott Mines Company

feeding their horses "states" alfalfa and timothy hay which the superintendent told me had cost $300 a ton laid down at the mines. This was hauled in from the coast during the winter on snow by horses, and at much less cost than if packed in in the summer time. Probably $285 of the $300 per ton was for transportation from Seattle to destination.

Horse feed—hay and grain—at the road houses costs from 15 to 25 cents a pound.

Under this handicap of high cost of food supplies shipped from the "states," and consequent high wages, it is perfectly apparent that only the few rich strikes of placer gold and high grade ores

FIG. 7—A Tanana, Alaska, Hay Field.

can be worked, while the many claims of lower values but totaling vastly more wealth, must be unworked, awaiting a cheaper food supply and lower wages. Lines of railroad extending from the south coast into the interior, supplemented by wagon roads that can be used summer and winter, will greatly relieve the situation, but even then, with the base of supplies 1,000 to 2,000 miles away, cost of living and labor will be too high to permit the largest development of Alaska's resources.

Finland, Sweden, Norway and Iceland, comprising areas totaling 100,000 square miles less land than Alaska contains, lying between the same parallels of latitude, and having climatic conditions not very different from those of Alaska, but far less rich in

mineral and other natural resources, have 12,000,000 people against Alaska's white population of 35,000. Is it unreasonable to expect great development in our northern possession in the next decade? Transportation must lead the way to this land of wealth, and agriculture must sustain the workers, if there is to be full fruition.

ARGENTINE PATAGONIA
A LAND OF THE FUTURE

BY

MARRION WILCOX

Argentine Patagonia is divided into five parts, namely, the Territories of Rio Negro, Neuquen, Chubut, Santa Cruz, and Tierra del Fuego, whose combined areas (about 775,000 square kilometers, or 302,250 square miles) exceed the total area of the Republic of Chile (the latter being about 756,990 square kilometers) and constitute between one-third and one-fourth of the entire area of the Republic of Argentina, or nearly one-twentieth of the continent of South America. The comparatively small part of this region which is included in the Chilean Territory of Magallanes was commented upon in the *Bulletin* for November.

In view of the circumstance that its climate, ranging from temperate to cold (since it extends, roughly speaking, between lat. 40° S. and lat. 55° S.) favors the development of vigorous communities, we note with special interest any record of Patagonia's agricultural achievements which may tend to demonstrate the fertility of the soil, accessibility of the little-known interior districts, facilities for irrigation, etc. The question whether this distinctly habitable one-twentieth of South America possesses such elements of substantial prosperity has entered a new phase quite recently; and it is obviously a very large question. An optimistic view of that question is supplied by Guiliermo L. Friedrichs, of Córdoba, Argentina, who has contributed a paper entitled "Die Wirtschaftliche Erschliessung Patagoniens" (*Der Tropenpflanzer,* May, 1910).

The studies of Mr. Friedrichs bring to notice again the race between England and Spain for the control of this region. In 1774, the Jesuit Thomas Falkner, having penetrated to the heart of the country, found the interior so unexpectedly desirable that he urged

England to undertake its conquest. The Spanish Government, when this project became known, hastened to take formal possession of the coast by establishing forts. On Dec. 15, 1778, an expedition was sent from Montevideo, and after a voyage of twenty-two days a landing was made on the north shore of Valdez Peninsula. The bay (a portion of the Gulf of San Matias) where this landing was effected received the name San José. Spanish settlements were established there and at Puerto Deseado—the latter in what is to-day the Territory of Santa Cruz. When Spain was on the point of losing forever her control over Argentina, England decided to strike, but, aiming first at the capital, neglected to put sufficient force into the blow—and English regimental flags are still to be seen, in frames and under glass, on the pillars of S. Domingo Church at Buenos Aires. A quarter of a century passed. Argentina, distressed by war and political dissensions, was shunned by nearly all Europeans, excepting soldiers of fortune. Then, after 1832, the world received from one of its greatest men extremely unfavorable impressions in regard to the Far South. When Captain Fitz Roy on the *Beagle* was devoting his attention to Patagonian hydrography, Charles Darwin, as naturalist, pursued his investigations on land. But inasmuch as Darwin's studies were in the main confined to the dreary, repellent wastes of the littoral, he of course depicted the land in darkest colors on account of its lack of water and vegetation. To this condemnatory judgment was due, in part, the delay in colonizing central and southern Patagonia. In this connection, Mr. Friedrichs also notes the mistake of the eminent scholar Dr. Burmeister when he declared the Pampa Central to be wholly unsuited to wheat growing!

Genuine colonization of Central Patagonia—the Chubut Territory—began in the year 1865. In 1862 an important emigration society had been formed in England with the object of establishing colonies in Patagonia. Two representatives had examined Chubut Valley, and subsequently applied to the Argentine Minister of the Interior, Dr. Rawson, for an assignment of national government lands. In the name of the government the minister stated that he was ready to give to each family of immigrants 25 square "cuadras" of the national land. On July 28, 1865, a ship arrived from Liverpool with 153 Welshmen on board, and in September of the same year Col. Murga, thereto commissioned by the government, came to point out to the immigrants the land assigned to them in Chubut Valley. On September 16 the colony was formally established. The

Argentine flag was hoisted and the place received the name of the Minister of the Interior, Rawson.

From the very beginning a lack of means of subsistence occasioned great suffering. Forty-eight newcomers abandoned the community, and the government, whose energies were absorbed by the war with Paraguay, could extend no aid. Fortunately the starving Welshmen obtained a little food from the Tehuelche Indians. The second harvest was a failure because the rainfall was insufficient. When the colonists abandoned their settlement and betook themselves to the neighborhood of the port of Madryn, Dr. Rawson promised support to the poor people and requested them to remain one year longer in the colony. Thereupon irrigation canals were cut. At one stroke the situation changed. Splendid crops of wheat were produced. From the year 1867 onward the harvests were good, but communication with the outside world was very imperfect. Application was made to the national government for assistance in exporting wheat. New bands of Welsh immigrants came in 1874 and 1875. Chubut wheat was then sent to Buenos Aires and the Falkland islands.

The colonists established a species of autonomous government, electing for this purpose a council which consisted of twelve members, and which promoted the public interests and discouraged private quarrels. This council of twelve elected a president. Thus matters stood until 1876, when a commissioner was appointed to represent the national administration. In 1881 the inhabitants of Chubut Valley numbered 1,000. The law of October 16, 1884, relating to the National Territories, prescribed for Chubut the following boundaries: On the north, Lat. 42° S., on the east the Atlantic Ocean, on the south, Lat. 46° S., and the Chilean frontier on the west. Under this law a Governor, a Federal Judge and other officials were assigned to each Territory. The first governor of Chubut, L. J. Fontana, installed the territorial administration at Rawson.

Governor Fontana promptly realized that he knew nothing about the 10,000 square leagues constituting his realm. Therefore, in the spring of the year 1885 he set out with thirty men to explore the Andean valleys. The entire outfit—provisions, a large number of cattle, etc.—had been supplied by the participants themselves; and the reason why so many colonists undertook the journey was that certain friendly Indians had told them about the fruitfulness and beauty of the Cordillera valleys, and the agreeable climate prevailing there had been the subject of much praise. The interior of Chubut Territory had, indeed, been studied at certain points by foreign

geologists and botanists, but not a word had been said about the agricultural possibilities of the hinterland; and in Buenos Aires the commercial world knew probably less about the southern Territories than did the people of Europe.

Fontana's expedition reached the foot of the Cordilleras after a journey of three months, and there the wanderers discovered a beautiful wide valley which their leader, in honor of the day on which the territorial divisions had been decreed, named Valle 16 de Octobre. A stock-farming colony was founded there. Fontana has characterized the newly discovered regions in the south as follows: "There were thirty of us and we belonged to four different nationalities, yet all declared to me unanimously that they had seen no other spot on earth where nature had combined on such a liberal scale whatever is necessary for the welfare of mankind."

Mr. Friedrichs says the Rio Negro Valley and the Limay region have been described by some writers as very fertile, while others have represented them to be entirely worthless for agriculture. If a visitor happened to come at the close of a rainy season he found luxuriant vegetation; whereas another visitor arriving in time of drought could scarcely obtain fodder for his horse. The facts that the wheat grown in the valley of the Rio Negro is as good as or better than the Chubut wheat, and that both are superior to the wheat grown in the warm northern provinces, deserve to be kept in mind. The assertion has been made that the Rio Negro Valley in many respects is like the Nile Valley. Its total length, from the point where the Neuquen and Limay rivers unite to form the Rio Negro to the disemboguement of the latter in the Atlantic, is about 275 miles, and the average width about four miles.

Great Britain's old ambition to which we have referred has in our own times manifested itself in the construction of railways and the investment of hundreds of millions of dollars in the development of the country. On June 1, 1899, the railroad connecting Bahia Blanca and Buenos Aires with Neuquen was opened, and this gave ready access to regions which formerly were reached by long stage-coach journeys. Mr. Friedrichs says that the English spirit of daring which undertook the extension of the great system of the Southern Railroad merits recognition. The region to be crossed was in part so poor that the prospect of good financial returns was frankly admitted to be remote, and no colonization could be expected to follow except in the Rio Negro Valley. But English capitalists looked far beyond the present and saw in the line connecting Bahia Blanca with Neuquen only the first half of a great Trans-Andine route. The

Southern Railway will lay its track over the high valleys of mountain chains that extend between Neuquen Territory and South Chile. Its director, Dr. Moyano, was consulted last year by the President of Chile in regard to the proposed new route, and the approved plan appears to be for a line that, on the Chilean side, shall run through the Bio-Bio defile. The construction of such a road would add greatly to the prosperity of Bahia Blanca, which has, as its most valuable asset, a natural harbor, much deeper and better for large vessels than the harbor of Buenos Aires or any other place in the extreme southeast. Indeed, Bahia Blanca is sometimes called the future emporium of Argentina, or even the future Argentine Liverpool, because it appears to be destined to become an independent maritime starting-point for trans-continental traffic when the extension of the Neuquen road connects with the Chilean National railroad system.

As evidence of the interest that the Argentine Government takes in the southern Territories, we may mention the construction of the Patagonian Railroad, which was begun in 1908. This line will unite the port of San Antonio with Lake Nahuel Huapi and pass through Valcheta Colony. The first stretch from San Antonio to Valcheta (120 kilometers) is already finished. The projected railway system includes two lines, one from Comodoro Rivadavia to the Cordilleras, the other from Puerto Deseado, in Santa Cruz Territory, to a point in the Andes where it will meet the line from Rivadavia. Both may be operated in connection with the steamship service—the Linea Nacional del Sud—that has been established between Buenos Aires, Bahia Blanca, and Punta Arenas.

The discovery of petroleum about three years ago near Comodoro Rivadavia is another factor in the growing prosperity of the South, the product of the oil wells having been commended both for quantity and quality, according to Mr. Friedrichs. He says also that the cultivation of cereals, with all its promise, is at present not the most important source of wealth. Stock-farming, especially sheep-farming, dominates in this field, yielding very large profits. New port-works, extension of the sheep industry, plans for rendering navigable the Patagonian rivers, the production of minerals in the cordilleras and the Far South—all these forms of activity show that in a commercial sense Patagonia is to be regarded as a land of the future. The progress made in the last decade proves that these Territories can at least produce all that is requisite for the continuance of prosperity, if the statesmen of the Argentine Republic succeed in turning a stream of immigration in that direction.

The Territory of Neuquen has to-day about 30,000 white inhabitants, most of whom are Chileans, and about 10,000 Indians. These 40,000 persons possess or are in the employ of those who possess 195,000 cattle, 105,000 horses, 676,000 sheep, 170,000 goats, and 7,000 mules. Considering only one item, we note that there are 16.9 sheep for each man, woman, and child!

The Germans in Buenos Aires have decided to show newcomers from the Fatherland the way toward the South. By decree of September 7, 1908, the German-Argentine Colonization Society received a concession of 600 leagues of land in Santa Cruz Territory. Three cattle-farming colonies are to be established, and the effort is being made to secure, as immigrants, Germans, Austrians, Swiss, Danes, Norwegians, and Swedes—people from central and northern Europe, who will find in various parts of Santa Cruz climatic conditions similar to those of their native lands. Some progress has been made in the plans for rendering navigable the Santa Cruz River. In 1909 the steamer *Rio Gallegos,* carrying many passengers and a cargo of 80 tons, succeeded in going up against the rapid current of that stream as far as the Rincon Chico region, which was formerly regarded as inaccessible. The feasibility of plans for river improvement which shall enable larger vessels to come and go between the wide interior zone and the outside world has to be conceded.

Of course all progress in this land depends upon an immigration of intelligent and industrious people. Let us scrutinize for a moment the facts in that connection.

The Commerce and Industry Department of the Ministry of Agriculture in Argentina has published a pamphlet which shows that from 1857 to 1908 the entire republic received 3,178,456 immigrants. But the Germanic element is represented in that total very inadequately, as follows: British, 42,765; German, 40,655; Austrian, 53,250; Swiss, 28,344. The quality leaves something to be desired: too many worthless elements enter the country. Even such an optimist as the gentleman who writes from Córdoba cannot believe that Argentina's future will be altogether blessed unless the immigration from the Mediterranean countries shall be offset by a greater proportion of Anglo-Saxons and Teutons. Ninety-five per cent. of Italian, Turkish, and Arabian immigrants are said to be illiterate.

In "A History of South America," by C. E. Akers, we may read that President Roca visited the Welsh settlement on the River Chubut and the settlements on the Gallegos and Santa Cruz rivers eleven years ago; and altogether the interest shown by Roca in Patagonia gave encouragement to residents. "Hitherto the welfare of

these southern colonies had been neglected, as they had never been regarded as a factor of national importance; but this action of Roca brought to notice the fact that civilization was spreading to them." It was a good and useful thing that Julio Roco did when he listened to the appeal of an outcast region, condemned through misunderstanding by a world that needs all its outcast regions.

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

MEETING OF THE SOCIETY. A regular meeting of the Society was held at the Engineering Societies' Building, No. 29 West Thirty-ninth Street, on Tuesday evening, November 22, 1910. Vice-President Greenough in the chair.

The following persons recommended by the Council, were elected to Fellowship:

Taylor More,	George Blumenthal,
S. Emerson Findley,	C. Bayard Staples,
George H. Middlebrook,	Lee S. Burridge,
Emil Mosonyi,	James G. Cannon,
George H Partridge,	Frederick H. Eaton,
James S. Camp,	Henry St. John Hyde,

Howard F. Chappell.

The Chairman then introduced Mr. Frederick Monsen, who addressed the Society on "A Journey from Vera Cruz to Mitla." Stereopticon views were shown. The Society then adjourned.

NORTH AMERICA

DR. HAYES AT PANAMA. Dr. C. Willard Hayes, geologist of the U. S. Geological Survey, has been visiting Panama, by the direction of President Taft, to make a preliminary study of the geological formations in the Canal Zone, with special reference to the excavations at the Culebra cutting.

Upon the results of his investigations will depend the decision whether a geologist will be permanently assigned to assist the Canal Commission.

THE HUDSON BAY RAILROAD. As the BULLETIN has already announced, the starting point of the line to Hudson Bay is to be the crossing of the Saskatchewan River at Pas Mission. From this point, *United Empire* says, it is not yet entirely decided where the road shall strike Hudson Bay. It will be built northeastward to the bay, either to Fort Churchill (477 miles) or to Port Nelson (410 miles), the latter route being favored by the engineers who carried out the survey, the distance being shorter, the difficulties less serious, the region passed through being better suited to development and the harbor having an advantage in other important respects. The Nelson route is estimated to cost $22,500,000 for railroad and harbor works, about $5,000,000 less than the other

route. On the Bay everything will have to be created, not merely a town built but the numerous accessories involved in the opening of a new ocean route provided. The southwestern terminus as yet has no center of population. Saskatoon, the nearest center of any size, is 250 miles remote as is the nearest point on the Grand Trunk Railroad. The farmers of West Canada, however, enthusiastically support the project, which they declare will vastly benefit the great grain lands of the Dominion and they say the road should be built immediately by the Government.

LECTURES AT COLGATE UNIVERSITY. The public lectures of the Department of Geology and Biology at Colgate University, during the Winter will be by Pres. E. B. Bryan, "The Philippine Islands"; Dr. L. A. Bauer, "The Magnetic Survey of the Globe, and the Work of the Yacht Carnegie"; Prof. R. DeC. Ward, of Harvard, "The Coffee Country of Brazil With Special Reference to Climate" (results of observations in the past Summer); Prof. Herbert E. Gregory, of Yale, "Explorations in the Navajo Reservation" (during the past two seasons); Prof. A. P. Brigham, "Geographical Influences in the History and Commerce of the Italian Cities"; and Prof. W. M. Chester, "The Bermudas,—the Islands and Their Life" (Studies in 1909 and 1910 with Harvard Expeditions).

SOUTH AMERICA

CHILE'S GREAT RAILROAD LINE. The late Pres. Montt, in his last message to the Chilean Congress, expressed the hope that in four years the entire railroad line, between Puerto Montt and Pisagua, about 1,550 miles in an air line, would be in operation. The last session of Congress voted over $2,000,000 for carrying on the work of building this railroad to the north of Santiago. A British syndicate has this work in progress. At Lagunas the system of nitrate railroads will be used to extend the road to Arica. Meanwhile, the railroad from Arica over the Cordilleras to La Paz, Bolivia, is rapidly building. To the south of Santiago, the railroad has been in operation for some years, as far as Osorno and in June last work began on the stretch of about 100 miles, which will connect the far southern port of Puerto Montt with Osorno and thus complete the southern section of the line, which, extending along the western foothills of the Cordilleras and through the Great Valley of Chile, will give uninterrupted railroad service, north and south, to the most important part of the Republic. (Condensed from *Pet. Mitt.*, 56 Jahrg., 11 Halbband, 4 *Heft.* 1910.)

SOUTH AMERICAN RAINFALL TYPES. With the object of making a map of the rainfall provinces of South America simple enough for general use, and yet accurate enough for scientific presentation, William Gardner Reed, Jr., has studied all available rainfall maps and rainfall data for South America (*Quart. Journ.* Roy. Met. Soc., Jan., 1910). The monthly rainfall of each station, expressed in hundredths of the annual mean, was shown by means of a curve on a small coordinate card, and this card was then fastened to a large map (8 ft. x 5 ft.) of South America. (The map itself was drawn on a screen from the projection of a lantern slide made from the Kiepert map.) The rainfall provinces were then marked out, at first by means of strings hung on the map by pins. This method made it possible to shift the boundaries until the most satisfactory provinces were obtained. A comparison of the resulting subdivisions with previously published maps is made. The author concludes that the map

of Voss (*Pet. Mitt.*, 1907,) is the most accurate yet published, and "that this map, with a few minor corrections, shows the rainfall relations of South America as far as they can be determined by the present data." R. DEC. W.

AFRICA.

HYDROGRAPHIC MISSION IN FRENCH EQUATORIAL AFRICA. Mr. Roussilhe, chief of the Congo-Ubangui-Sangha Mission, with several engineers and surveyors, left Paris on Oct. 23, for Africa to carry out hydrographic studies along these three rivers, particularly at the Falls of Zongo at the head of navigation on the lower Ubangi. Their work includes the study of river regulation for transportation purposes and of the development of the Port of Brazzaville.

THE MURDER OF LIEUTENANT BOYD ALEXANDER. The London *Times* prints details of the murder of this explorer (*Bulletin*, July, p. 527), who was killed in Wadai while on an important expedition across Africa. The explorer and his Portuguese collector José had reached a place called Tama, late at night. The local chief summoned them to his presence and Lieut. Alexander replied that he would see the chief on the following morning. Soon after, a number of persons came to his camp, which was just outside the town, and declared their intention of taking the explorer to the chief. One of the men laid hands on the British officer, who pushed him off, whereupon a small boy who was standing by, seized a gun and fired at the explorer, who fell to the ground. The crowd then set upon him and ended his life. Four natives then seized José and wrenched a ring from his finger. He said he would remove another ring which they wanted, but as soon as he was released, he seized his gun, fired two shots at his assailants and, jumping on his horse, made his escape. The attitude of the Tarna people was, doubtless, due to the fact that they had had trouble with the French and, hearing of the arrival of an unknown white man, they expected further hostilities.

LAKE DILOLO. During the recent survey of the Belgian Congo-Portuguese Boundary in the neighborhood of Lake Dilolo, it was found, according to *Le Mouvement Géographique,* that this lake which for years has been only a wide swampy region, bids fair in time, entirely to dry up. Its hydrographic relations are now wholly with the Zambesi. Ever since its discovery this Lake has seemed to be so exactly balanced on the Zambesi and Congo water parting that it was believed to be tributary to both river systems.

ASIA

CHINESE TOPOGRAPHICAL MAPS. The Chinese Government, through its Land Survey Bureaus at Peking and Nanking is issuing sheets containing the results of the topographic surveys, which it is beginning to make. Very little is yet known of the activity of these native survey bureaus except through the map sheets which they are issuing. The Government is not yet selling the sheets to the public, but a number of them have been sent to Europe. A part of the sheet "Tai-Ping-Tji" is produced in the *Zeitschrift* of the Berlin Geographical Society (No. 4, 1910) and is accompanied by a short description, written by Dr. M. Groll.

This sheet is from the map of the Kiang-su Province. The whole Province on both sides of the Yang-tse River is being topographically surveyed and mapped on the unusually large scale of 1:20,000. The sheets are printed in

black only, and though they give a great deal of detailed information, the work lacks the refinement seen on the topographic sheets of most of the western countries. China has never before printed so much detail on her maps and so accurately shown it; but that the greatest accuracy has not been sought seems evident from the fact that the surveyors were only twenty days in securing the data for the sheet Foschan, in which many mountains are shown. The surveyors appear to have determined only a limited number of elevations and connected these points by contours only approximately accurate, sketching them in with a free hand. It is evident, however, that these contours of elevation are a very fair generalization of the surface features. For example, the mountain chains to the east of Nanking and the volcanic territory on the north shore of the Yang-tse River are well characterized.

The sheets use many symbols to differentiate plowed lands, forests, rivers, bridges, dams, telegraph and railroad lines, first class and common highways, etc. The street plans of the larger cities are given, but the positions of smaller settlements are merely indicated. Unfortunately, all the names and the explanatory text appear only in Chinese characters, though Arabic figures are used for heights.

Dr. Groll says that as these surveys progress they will doubtless bring to us many surprises. For example, the maps he has examined show that a certain area along the lower Yang-tse, has been diked, canalized and inhabited, though the latest British Admiralty chart marks this region as covered by water.

AUSTRALASIA AND OCEANIA

Volcanic activity on Heard Island. A communication to the Paris Geographical Society announces that Capt. Dasté, master of the ship *Mangoro*, while passing Heard Island in March last, observed that its highest peak, which in 1874 received the name of Kaiser Wilhelm Berg was in complete volcanic activity and immense clouds of smoke were rising high in the air. This island, which lies in the Indian Ocean about 300 miles southeast of the Kerguelen Islands, had been last visited on Feb. 3, 1902, by the German South Polar Expedition. When the *Challenger* Expedition visited the Island in 1874, traces of volcanic activity were found.

It is noteworthy that 17 miles N.N.E. of Bligh's Rock, a small island belonging to the Kerguelen group, a depth of only about 60 feet is found, which is proof of the great extent of the submarine plateau of which the Kerguelen Islands form the highest part. (*Zeitsch*, Gesell. f. Erdk. zu Berlin, No. 8, p. 529, 1910).

Trans-Continental Railroads in Australia. The *United Empire* (vol. i, No. 2, 1910) says that the plan to connect Port Augusta, South Australia, with Coolgardie, Western Australia, by rail and thus complete the east-west transcontinental line is a sound financial project and the building of the road is not likely to be delayed. The distance to be covered is 1,063 miles. A Commission on which the Commonwealth and the two states above mentioned were represented has made a detailed survey of the route and estimates the cost at about $20,000,000. The line, which bids fair to pay its way, would bring the people of the eastern states two or three days nearer to London, facilitate the prospecting of a region of mineral possibilities, serve the expanding Tarcoola mining field and promote Australian national feeling, for the people of Western Australia regard their isolation from the eastern states as a real grievance.

EUROPE

The German Colonial Congress. Der Deutsche Kolonialkongress, 1910, held its meting in the Reichstag building, Berlin, on Oct. 6-8, under the presidency of Prince Johann Albrecht of Mecklenburg. The attendance, as usual, was large, including many active field participants in the work of development and students of colonial affairs. Besides the general sessions of the Congress, the programme was divided among seven sections holding simultaneous meetings: (1) Geography, Ethnology and Natural History of the Colonies and over-sea Interests; (2) Tropical Medicine and Hygiene; (3) The Legal and Political Conditions of the Colonies; (4) The Religious and Cultural Conditions of the Colonies; (5) The Economic Conditions of the Colonies; (6) Settlement in the German Colonies and Emigration to foreign Lands; (7) Economic Relations of Germany and her Colonies with other Lands. Ten addresses were made in the general meetings and 63 papers were read in the sections.

The Royal Colonial Institute. The Duke of Connought has become President of the Royal Colonial Institute in succession to King George V who occupied that position while Prince of Wales and who is now Patron of the Institute.

A Swiss National Park. It is gratifying to see that the liberal policy of our Government in setting aside reservations to be kept in a state of nature as public recreations grounds is exciting attention and imitation abroad. Prof. Conwentz of Dantzig has been especially active in arousing interest in natural monuments throughout Germany, and now, as we read in *Globus,* a society in Stuttgart has issued a brochure on "Naturschutzparke in Deutschland und Oesterreich," with the object of furthering the preservation of selected areas in their natural condition. In Switzerland there is a "Naturschutzkommission," in which the zoological explorers, Fritz and Paul Sarasin of Basel, have leading parts. An inventory of "Naturdenkmäler" has been made, including even exceptionally fine trees and unusually large erratic blocks; and from the beginning of 1910, a national park, the first in Switzerland, has been created by setting aside the lofty Val Cluoza in the Lower Engadine, from all commercial uses. No pasturing animals are there to be seen, no gun or ax is to be heard. Access to the park is had from the village of Zernez. The enclosed valley has a great vertical range, and consequently a full representation of floral zones. In this connection an interesting problem arises as to the effect that a century or more of summer pasturing on the grassy slopes above the forests may have had in exterminating plants that cannot endure annual cropping; the change in the proportion of different plants in the former pasture zone of the Cluoza park will, therefore, be closely watched, and the new-comers will be regarded as returning exiles.

W. M. D.

A Monument to the Memory of Dr. Hamy. A large committee has been organized under the patronage of Prince Albert of Monaco, to raise funds for the erection of a monument to the distinguished anthropologist, the late Theodore J. E. Hamy, at his birthplace, Boulogne-sur-Mer.

POLAR

Lieut. Filchner's Antarctic Expedition. A Reuter despatch says that this German explorer announced, at a meeting of German naturalists in Königsberg, that the start of his Antarctic expedition could with certainty be fixed for the

spring of 1911. He added that he had agreed with Captain Scott who will start from Ross Sea for the Pole, while Lieut. Filchner's base will be the Weddell Sea, that, if the expeditions meet in the center of the Antarctic, some of Captain Scott's party will accompany him while a detachment of his own party will go with Captain Scott.

STEFANSSON AND ANDERSON IN THE ARCTIC. The latest letters received by the American Museum of Natural History, from Messrs. V. Stefánsson and R. M. Anderson, reveal a story of hardship and of sturdy effort, whose results were at least delayed, in part, by storm and illness. The expedition left New York, in May, 1908, its main object being to make a scientific study of little-known Eskimos, especially those tribes east of the Mackenzie River at Coronation Gulf with its Coppermine River, and on Victoria Land to the north, where there are opportunities to study tribes wholly uninfluenced by the white race. The study of the Eskimos is especially in the hands of Mr. Stefánsson, while Dr. Anderson carries on a zoological survey and makes collections of mammals, birds and fish.

The party had expected to go to the eastern Eskimo tribes, by whaling ship, but as no whaler visited the region for a year, the expedition was forced to spend the first winter in the lower Colville region, where game was very scarce and the party had an uncomfortable experience. As a matter of fact, supplies sent to the explorers by the Museum, which left San Francisco on April 24, 1909, had not yet reached the expedition in the spring of 1910, when the last letters were sent out.

The party came safely through the difficulties of the winter and their main energies in the summer of 1909 were spent in getting eastward. Mr. Stefánsson succeeded in getting as far east as Cape Parry and intended to make a dash from there for the Coppermine River at the opening of last Spring. His letter gives many details of the serious deprivations of last winter, due to insufficient clothing, a very small stock of provisions and the scarcity of game. The letter reports that in March last all were "in fit condition showing no serious after effects," and that Mr. Stefánsson was expecting to start with his party, during the first week in April, for the Coppermine. The expedition is expected to come out of the field soon.

Upon his return here, Mr. Stefánsson will have five years' knowledge of the Eskimo. He has accomplished much in getting records of songs and folklore, working to ascertain definitely, the presence and variations of certain folktales throughout the tribes. He has complete lists of words used by the Shamans in ceremonials, a large series of head measurements and many photographs. Mr. Anderson is expected to bring back many specimens of Arctic fauna. The sum total of results attained by the explorers will doubtless possess much value.

INLAND ICE OF THE ARCTIC REGIONS. In a recent paper Prof. W. H. Hobbs presents a summary of our knowledge of the conditions of the inland ice of the Arctic regions (*Proc.* Amer. Phil. Soc., vol. xlix, 1910, pp. 57-129). He first discusses the causes which bring about the necessary snowfall and then discusses individual areas, primarily the ice-caps of Norway, Iceland, Franz Josef Land, Spitzbergen and Greenland. The islands of Franz Josef Land are the most arctic in their aspect of all the smaller northern land masses, and, with the exception of these islands, all the northern ice sheets are smaller than the land

masses upon which they rest. Naturally, the greatest attention is paid to the largest of these areas of inland ice, that of Greenland, and in this part of the paper much attention is paid to discussion of the modes of accumulation of the ice, the condition of the interior, and the characteristics of the margins, with quotations and references to various papers upon the subject. Prof. Hobbs has done a service in presenting within the compass of a single paper a summary of some of the salient facts with regard to northern glaciation, having gathered them from a wide variety of sources in several languages. R. S. T.

CLIMATOLOGY

Automobiles and Climate. That railroad construction and operation is very markedly controlled by climate is obvious to anyone who looks into the question at all carefully, yet no systematic presentation of the facts in the case was attempted until Mr. Robert M. Brown published, a few years ago, his suggestive paper on this subject (*Journ. of School Geogr. II,* 1903, 178-190). The new method of travel and transportation, by automobile, has not yet shown very noticeable climatic controls, yet signs are not wanting that adjustments along these lines are coming. For example, the automobiles used on the Shackleton expedition were especially designed for travel over the Antarctic ice, and now comes the interesting statement, from the U. S. Consul at Johannesburg (*Consular and Trade Reports*), that manufacturers of American automobiles sent out to the Transvaal should regard climate if they wish to sell their machines. It is pointed out that, as the climate is for the most part very dry, wood, if used, must be well seasoned. Much difficulty has been experienced with wooden wheels made of materials not well seasoned. Bad roads are the rule, and as many small streams are encountered a high clearance is recommended. A good quality of paint must be used. A poor quality rapidly deteriorates in the hot, dry climate. R. DeC. W.

Free Air Temperatures.—In the *Bulletin* of the Mount Weather Observatory, (Vol. II, Pt. 4, 1910), Prof. W. J. Humphries summarizes and discusses the "Vertical Temperature Gradients as Modified by Seasons and by Storm Conditions," basing his conclusions upon the results of European observations obtained by means of *ballons-sondes.* Curves are shown illustrating the average winter and summer gradients, and the average winter and summer storm gradients. It appears that a high barometer is generally accompanied by a cold isothermal region and a warm lower atmosphere, the latter extending from near the level of the upper inversion down to about two kilometers above the earth's surface in winter, and all the way down in summer. A low barometer is commonly associated with a warm isothermal layer and a cold lower atmosphere, the latter reaching the earth in summer but in winter extending down only to about the two kilometer level. These temperature inequalities seem to be due principally to the unequal radiating powers of moist and dry air. Moist air warms the air of the isothermal layer by a rapid supply of radiant energy, itself becoming cold in the process. Dry air, being a poor radiator, conserves its own heat, and itself remaining warm, allows the isothermal layer to grow cold because of the decrease in the supply of heat.

R. DeC. W.

PHYSICAL GEOGRAPHY

The North Atlantic Deep Sea Expedition of the "Michael Sars" in 1910. The *Bulletin* announced (p. 126) the proposed Deep Sea Expedition in the At-

lantic during the past season for which the Norwegian Government donated the use of its research steamer *Michael Sars*. The expedition led by Sir John Murray and Dr. Johan Hjort, of the Department of Fisheries, Norway, left Bergen at the end of March and was at work for four months. A concise account of the results of the investigation from the pen of Dr. Hjort is printed in *Nature* (Nov. 10, 1910, pp. 52-55). The party followed the coasts of Europe and Africa down to Cape Bogador and made special investigations in the Bay of Biscay, the Bay of Cadiz and the waters between the Canary Islands and Africa. It then traversed the Sargasso Sea, touched at the Azores, proceeded to St. John's N. F., then crossed the Atlantic eastward to the south coast of Ireland and finally examined the waters between Scotland and the Faroes, so as to study the influence exerted by the Atlantic upon the Norwegian Sea.

The large number of observations and specimens cannot be properly described until they are well studied, but some information may be given here as to their nature and extent.

Temperature readings were taken at many depths and also water samples from all depths to determine salinity and specific gravity. It was found that there is a faint increase of temperature near the bottom at great depths, due possibly to the conduction of heat from the interior of the earth or a radium effect. Altogether 2,500 water samples, and 3,000 temperature readings were taken.

In the vertical net hauls, the special aim was to obtain material for comparing the plankton of the coast banks with plankton from purely oceanic waters and also to compare sub-tropical and boreal conditions of existence. The coast banks off Ireland, the west coast of Africa and the Newfoundland banks have a characteristic flora, which is sharply marked off from the oceanic flora, rich in species, but poor in individuals, which is met with in the central parts of the Atlantic, and especially in the Sargasso Sea. The samples from the more northerly waters show a greater quantity of plants than the subtropical portion of the ocean.

A large-sized model of the ordinary otter-trawl was used at various depths, and Dr. Hjort recommends it for investigations of the deep-water fish fauna. Essentially new types of fish were not taken, but the material brought up gives a good idea of the uniform fish fauna to be met with along the slopes of the coast banks of Europe and Africa. The hauls at great depths were few, but they indicate that the eastern deep ocean plain of the Atlantic is especially poor in all kinds of higher organisms and particularly in fish.

Monadnocks near Montreal. St. Bruno Mountain has recently been described by John A. Dresser (Geology of St. Bruno Mt., Province of Quebec, Canada. Department of Mines, Geol. Surv. *Mem.* No. 7, Ottawa, 1910). It is one of the Monteregian Hills, which rise as monadnocks above the level plain of the St. Lawrence valley, and reach a height of 650 feet above the adjacent plain. St. Bruno, like Mt. Royal at Montreal, with its hilly rim and lowland center with lakes, is shown to be not an extinct volcano, but a resistent intrusive stock of plutonic igneous rock, surrounded by more resistant metamorphosed sediments. In origin it, therefore, resembles the Crazy Mountains at the base of the Rockies near Yellowstone Park. The age of intrusion is probably late Devonian.

L. M.

The Owens Valley Earthquake. The Earthquake of 1872 in Owens Val-

ley, Cal., discussed by W. H. Hobbs (*Beiträgen zur Geophysik,* Bd. X, Heft 3, 1910, pp. 352-385), is one of the larger North American earthquakes not previously described. W. D. Johnson, who did the field work, and W. H. Hobbs, who carefully compiled this account from the literature, in connection with Johnson's maps, photographs, and descriptions, deserve great credit for this painstaking discussion of an earthquake in a thinly-settled region and so long ago that its complete record was in danger of being lost. The shocks of 1872, some of the facts concerning which had previously been presented by J. D. Whitney, G. K. Gilbert, and E. S. Holden, are described in relation to the topography and geology of the Owens valley. The information concerning the shocks, sounds, aftershocks, and landslides is presented, as well as derangements of water flow and permanent geological changes. The latter include the relationships of the faults and fissures, which seem to have been remarkably well preserved in this desert climate for the thirty-five years between the time of the earthquake and 1907, when Mr. Johnson made the detailed fault maps which are such an unusual and desirable feature of this paper. L. M.

GENERAL

Petermanns Mitteilungen. Under the editorship of Prof. Paul Langhans, this geographical publication has been greatly enlarged and is serving more fully than ever, the aim of its founder, Dr. A. Petermann, who endeavored, as he wrote, to make it "an authentic chronicle of geographic science in the widest sense of the word." In his announcement for 1911, Prof. Langhans notes that in all the continents, not even excepting Europe, large areas are still unexplored. "We have very meager knowledge of the geologic structure of many countries, of their climate, of their flora and fauna. The available material in ethnography is very incomplete and this condition should be remedied, because aboriginal peoples are rapidly losing their individuality. A new era of discovery has also dawned for the Polar regions." The *Mitteilungen* is obtaining a large number of original reports and summaries of new explorations in all parts of the world. In doing this, it is not sacrificing its high scientific character and is giving more attention than ever to the publication of original papers dealing with all phases of geographical science. It records in each number many contemplated exploratory enterprises, the book reviews and monthly list of "new publications" are comprehensive, and the monthly cartographic record of newly published maps, containing about 1,200 entries a year, is invaluable to geographic workers. The thoroughness with which this publication is now covering the field of geography, merits the appreciation of all workers in this wide study.

Answers to Correspondents. The following answers are given to several correspondents who have sent questions to the *Bulletin:*

"Please tell me where I may get information about the earthquake of 1811 and 1812. C. H. F., Wappingers Falls, New York."

The series of earthquakes to which you refer are known as the New Madrid Earthquakes and occurred in what is now Southeastern Missouri and Northeastern Arkansas in 1811-12. These shocks are well described by G. C. Broadhead (*Amer., Geol.* vol. xxx. 1902, pp. 76-87); and by E. M. Sheppard (*Journ.*

of Geol., vol xiii, 1905, pp. 45-62). There is a concise description of the New Madrid earthquakes in "Earthquakes" by W. H. Hobbs (pp. 174-77), D. Appleton & Co., New York, 1907.

"Please inform me how near completion the Cape to Cairo R.R. is at present? H. W. N., Saratoga Springs."

The northern section of the road has been extended from Khartum up the Blue Nile to Wad Madani, about 100 miles. It will be built up that river to Senaar and perhaps farther before it turns to the White Nile valley, the idea being to circumvent the wide swamp region of the White Nile. There is now steam transportation from the Mediterranean up the Nile by rail to Khartum and on to Gondokoro by steamboat, within less than 400 miles of Victoria Nyanza. From the south, the line now in operation extends from Cape Town and Victoria Falls to Broken Hill, the present terminus of the main line; and a branch line to the N. W. is now in operation to the copper field of Katanga (Belgian Congo), so that there is continuous rail connection from Cape Town over 2,100 miles north. The whole line (Cape to Cairo) will be about 6,870 miles long, and about four-fifths of the distance is now covered by rail or steamer.

"What map of Russia showing the ethnography of that empire in the 19th century is to be recommended?"

An excellent map is "Carte ethnographique de la Russie d'Europe" by D. Aitoff. Scale, 1:12, 500,000, or 197.2 statute miles to an inch. It was published in *Annales de Géographie,* No. 79 (1906), by Armand Colin, 5 Rue de Mezières, Paris, France. Price 4 frs. Though small, it is a good, clear map in seventeen tints showing distribution of races in Russia in Europe and in Caucasia. Based on the census of 1897.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

NORTH AMERICA

American Inland Waterways. Their Relations to Railway Transportation and to the National Welfare; Their Creation, Restoration and Maintenance. By Herbert Quick. xx and 241 pp., 80 illustrations and index. G. P. Putnam's Sons, New York, 1909.

This volume is a strong and well-organized appeal for a better development of the interior waterways of the United States, in order that our own country may compete effectively with the great rival commercial nations of the world. The availability of markets depends on cheapness and quickness of transportation, to a large extent. For products that are bulky and not easily perishable, slow transportation by water is cheaper than rail transportation. Our own country has vast products of cotton, wheat, iron, corn, etc., that must be transported to market cheaply and hence must develop its interior waterways, or lose the leadership it now holds. Already the wheat fields of Canada are threatening to exceed in production the wheat fields of our own country, and a water route, as is projected, from Winnipeg to Liverpool by way of Hudson Bay, or from Fort William to Liverpool by way of Georgian Bay, will give Canada a great advantage in commerce.

The author writes somewhat pessimistically and in a way does not give full full justice to the possibilities of the United States along lines that have already been developed Yet the volume is interesting and convincing reading, in spite of a style that in places is almost "fine writing."

The seven chapters are entitled: "The Grand Strategy of Trade," "Bringing the Sea to the Farms," "The Railways and the Waterways," "Terminals a Vital But Neglected Matter," "The Rivers and the Conservation Movement," "The Long Look Forward in Transportation," and "The Battle of the Engineers."

The first chapter is a summary of the efforts of the several great commercial nations to increase their trade and of the relative opportunities of Canada and the United States in reference to the products of the West and Northwest. The second chapter is an appeal for national action that will bring the sea to the farms by the development of a "Lakes to Gulf Deep Waterway." This is followed by a summary of the railroad possibilities and the interior waterways possibilities in the United States, with an account of certain of the details of waterways improvement necessary to keep our great rivers in bounds.

Perhaps the most interesting chapter is the one devoted to terminal facilities in ports—a very pertinent matter at the moment, when the question is being discussed as to the future ability of New York Harbor to accommodate the largest ocean liners. The summary of the conservation movement as applied

to river storage systems and of the present navigability of the streams of the United States is full of facts that are little known and less appreciated.

The volume as a whole is a strong presentation of the problems of interior improvement that confront us as a nation, if we would become a commercial unit rather than a somewhat unrelated and independent group of commercial areas. Well illustrated, well printed and attractive in form, the volume is well worth reading, though one should guard against being swung away from rationality by the appealing play on the emotions which the author so skillfully uses. R. E. D.

The Railway Library, 1909. A collection of noteworthy chapters, addresses and papers relating to railways, mostly published during the year. By Slason Thompson. xvi and 403 pp. and index. The Gunthorp-Warren Printing Co., Chicago, 1910.

The book contains 19 papers and addresses on the present railway situation. The authors are men of eminence in railroad affairs. Their papers reflect the prevailing sentiments of some of our best-known railway officials and Mr. Thompson has done good service in bringing them together in this permanent form.

Houseboating on a Colonial Waterway. By Frank and Cortelle Hutchins. xxvi and 295 pp, many illustrations and index. L. C. Page & Co., Boston, 1910. $2.50.

Virginia offers great opportunities, very little improved as yet, to those who love the houseboat with its varied and restful enjoyments. This volume is a delightful book depicting leisurely life on a houseboat excursion along Virginian waterways. It is a pleasant book to read, and also contains many hints for the use of those who have had no experience in houseboating, but would like to try it. The *Gadabout* was the unconventional name of this floating home, and, unlike most houseboats, she was encouraged to travel by two little gasoline engines. The chapters are all the more attractive because it was the initial experience of the builders and occupants of the craft in the gentle art of houseboating.

Health Progress and Administration in the West Indies. By Sir Rupert W. Boyce, M.B., F.R.S., Dean of the Liverpool School of Tropical Medicine, etc. xv and 328 pp. 48 illustrations, including maps and plans (one map in color), appendices, general bibliography, index. E. P. Dutton & Company, New York, 1910. $3.50.

This is an excellent presentation of an important subject. The author's position as a leader in the West Indian sanitary revolution arouses interest which the book itself by its intrinsic merit succeeds in holding to the end. In the first chapter some account is given of the tribute in lives that was paid to the *Stegomyia* (the yellow fever mosquito) by the discoverers of the New World and the early colonists, beginning with the outbreak of yellow fever which occurred about 1493 in Santo Domingo. The second and third chapters contain a review not only of conditions during the eighteenth century and the first half of the nineteenth century but also of the old erroneous opinions in regard to the origin of West Indian fevers; and this portion of the subjects concludes with an explanation, in simple terms, of the modern discoveries of the relationship of

mosquitos to disease. In chapters IV to XV the beneficial changes which have been produced in many parts of the West Indies by civilization, with its attendant reforms, are carefully traced. Special attention is directed to health progress and administration in Barbados, Grenada, St. Vincent, St. Lucia, Trinidad, and British Guiana. The appendices furnish less extended comment on the French West Indies, Cuba, Porto Rico, Jamaica, the Bahamas, and British Honduras. M. W.

The Canadian Who's Who. Fred. Cook, Editor. xix and 243 pp. The Musson Book Co., Lim't'd., Toronto, 1910. $1.

The first edition of this publication, in typography and arrangement, is modelled after "Who's Who in America." As in the case of the Chicago publication, the subsequent editions will doubtless have a much larger list of names. As it is, the book will be useful to all who have occasion to learn facts of importance, with regard to one or another of a large number of prominent persons in the Dominion. The book was evidently compiled with much care.

SOUTH AMERICA

La République Argentine. Le Pôle Latin de l'Amérique. Description, Étude Social et Histoire. Par H.-D. Sisson. Troisième édition. ii and 327 pp. Plon-Nourrit et Cie, Paris, 1910.

Rosario, a progressive Argentine town that lights with electricity even the altar of its principal church (*Domus Dei et Porta Cæli,* is the inscription on the façade), instructs its citizens that the Argentine commander San Martín was America's leading military genius and the liberator of this hemisphere! In plain lettering on a monument near Rosario's city hall that assertion is made, naturally in the Spanish language and in the following terms: *"Gen. D. José de San Martín el primer génio militar de la America y el libertador de medio mundo."*

He was in fact the leading military genius and liberator of the southern part of South America. The young patriotism of Rosario makes a vastly larger claim. The people who live in the eastern portion of the Argentine Republic assume that no one else could have been greater than their own country's greatest liberator and military genius. We need not be offended. We who live in the northern part of the New World easily understand the mood of a vigorous young American nation, so confident of its own strength that it may forget at times the claims of others.

It is important that we should have this in mind before opening M. Sisson's book. If we turn first the pages which are devoted to Argentine history from 1810 to 1910, we shall see that M. Sisson, although he does not claim for San Martín the most distinguished position in the history of the New World as a whole, does place him above Bolívar, saying: "San Martín is certainly the true liberator of South America (*San Martín est certainement le vrai libérateur de l'Amérique du Sud*"). We have only to ask: Did he liberate Venezuela, Colombia, Ecuador? Again, on page 238 of the section devoted to the government, religion, and character of the Argentine people, M. Sisson expresses the opinion that, if Argentine makes good use of her advantages, *"elle est bien destinée, par la force des choses—par la Providence,—à devenir réellement le Pôle latin de l' Amérique."* We certainly share his views in regard to the re-

markable strength of Argentina's geographical location and her agricultural resources, but no student of American subjects should seem to ignore Chilean rivalry for control of the Farthest South—which region M. Sisson calls very picturesquely the Latin Pole. In other words, the author's sentiments at times appear to be those of an enthusiastic and patriotic Argentine citizen; and they are indeed to a large extent sentiments which are so ardently felt, so eloquently expressed by Argentine citizens as a rule that M. Sisson, *"qui, depuis quinze ans, a pu observer les Argentins,"* has caught the spirit perfectly. The chapter dealing with public instruction (pp. 153-166) does not give adequate attention to the service rendered to the nation by President Sarmiento, or by the teachers who brought from the United States, American ideals, methods, and constructive power. Chapter X of Part II, touching lightly Argentine society, contains some very interesting passages. The "conclusion," chapter xiv of the same part, is uncommonly well written: it is pretty good literature, and a bit of extravagance now and then will do no harm, since, as we have warned the reader, young Argentine patriotism is, occasionally, and more or less unconsciously, echoed or reflected.

M. W.

Géographie des Hauts-Plateaux des Andes. Par V. Huot. Mission Scientifique G. de Créqui Montfort et É Sénéchal de la Grange. 4to. 84 pp. Imprimerie Nationale, Paris, 1908.

In compact form, the best geography of the high plain (altiplanicie) of Bolivia and all the central Andean region. We find ourselves recalling as we read it the decidedly interesting little "Geografía de la República de Bolivia, Edicion Oficial, La Paz, 1905;" but of course the less ambitious aim of the latter is as palpable as are certain points of resemblance between the Spanish work and the French. M. V. Huot's special training and associations enabled him to combine research with exploration most effectively. It is known that fellow members of the French scientific mission lent their aid, and we think it is safe to assume the coöperation of distinguished scholars—Manuel V. Ballivián and others—at La Paz. The general purpose and main object of the mission having been the study of the inhabitants of the high plains, their languages and environment, investigations were carried on particularly in the domains of ethnology, philology, geology, mineralogy, zoölogy and physiology, and the following gentlemen were all more or less actively connected with some part of the broad plan: Dr. Chervin, G. Courty, Eric Boman, G. de Créqui Monfort, Dr. M. Neveu-Lemaire, M. Boule, E. Sénéchal de la Grange, C.-A. Pret, Adrien de Mortillet, and G. Grandidier. To M. Huot was assigned the congenial tasks of preparing a map on the scale 1:750,000 and describing that region in regard to which Sir Clements R. Markham recently said that "no country in the wide world possesses such a variety of climates, of geographical features, and of products." M. Huot calls this region of snow-peaks, bleak punas, and tropical valleys the Heart of the Andes, and has chosen as some of his main topics: The cordilleras which enclose the altiplanicie on the west and east; Lakes Titicaca and Poopó; the Argentine punas; Ethnic elements and the future of the people of the high plateaus; Means of communication, mineral wealth, and exploration of the central region of the Andes. He says rather more in praise of climatic influences (*e. g.*, on page 59) than cold hard facts warrant; but his error seems pardonable, for other explorers and travellers have usually said rather too much in dispraise of the Tibet of the New World.

M. W.

Le Brésil. Ses richesses naturelles, ses industries. Extrait de l'ouvrage: "O Brazil, suas riquezas naturales, suas industrias" publié par le Service d'Expansion économique du Brésil. Tome I. Introduction—Industrie extractive. 404 pp. Tome II. Industrie Agricole et Élevage—Voies et Moyens de Communication; Postes et Télégraphes—Industrie manufacturière. 416 pp. Many illustrations and statistical tables. Colored plates. Maps. No index. Libraire Ailland & Cie, Paris, 1909.

Brazil's desire to attract (for the development of her great latent resources) both immigration and capital has led to the production in recent years of a number of books designed to combat such unfavorable impressions as foreigners may have received in respect to the land and its climate, and to create favorable impressions wherever they will do most good. Such a work is "O Brazil," which, in this French version, somewhat condensed and embellished, certainly makes a good appearance. Accompanying the volumes are three large maps: (1) Brésil—Carte Politique et Économique, publiée par la Mission Brésilienne d'Expansion Économique, Paris, 1:5,000,000. (2) Estados Unidos do Brazil—Carte économique, 1:7,000,000; (3) Brazil—Segundo os mais recentes trabalhos, por R. Hausermann, 1:10,000,000. The preparation of the Portuguese edition was undertaken when the Minister of Industry, Communication and Public Works commissioned (December, 1905) the Centro Industrial do Brazil to assemble, in a single work, information touching all the industries and resources of Brazil. The scope of the original work was, in fact, encyclopedic; and we find in this French translation abundant material, varied in theme and degree of merit. Pages 9 to 68 are devoted to a sketch of Brazilian history from the year 1500 to November 15, 1906. Then follow, as important parts of the Introduction, the subtitles: Geography, Physical and Geologic Aspect, Climate, Population, Immigration, Governments—national, state, municipal, etc.

M. W.

Antiquités de la Région Andine de la République Argentine et du Désert d'Atacama. Mission Scientifique G. de Créqui Montfort et E. Sénéchal de la Grange. Vol. I., 4to, xi and 388 pp., 2 maps, 86 illustrations. Vol. II., 4to, 560 pp., map, 122 illustrations, anthropometric table of Indians of Susques, tables showing chemical analyses of prehistoric metallic objects, bibliography, index, etc. Imprimerie Nationale, Libraire H. le Soudier, Paris, 1908.

In 1903 the author made archæological investigations in the northwestern part of Argentina as a member of the Créqui Montfort-Sénéchal de la Grange scientific mission. The present work, an elaborate account of that journey, contains also abundant evidences of earlier studies—the observations he made on the Puna de Jujuy and in southern Bolivia (as a member of the Nordenskiöld Swedish Mission in 1901), and during travels in the provinces of Catamarca and Tucumán. The express design was, indeed, to embody in these volumes results of studies of the ruins and burial places of people who long ago inhabited the high valley of the Puna de Jujuy. A still wiser amplification of the main object of the journey of 1903 is to be noted. Mr. Boman did not neglect the present inhabitants of the Puna de Atacama, to whom more than 130 pages are devoted in the second volume.

The well-known views of Mr. Juan B. Ambrosetti, of the University of Buenos Aires, in regard to an autonomous Calchaqui or Diaguite culture are

attacked, especially on pp. 183, *seq.*, 187, *seq.*, 197, and 212. Mr. Boman says that for his part, his studies of the antiquities of the Argentine Republic have led to the profound conviction that the Diaguite culture formed an integral part of the Ando-Peruvian "civilization," and that it emanated almost entirely from ancient Peru. To us it seems that so much erudition and native talent have been displayed in support of both of these opposing views that the subject of the controversy is now invested with a degree of interest and importance not strictly inherent in it; and this, in the field of South American archæology, is a wholly exceptional outcome.

At the beginning of the first volume stands a commentary on M. V. Huot's ethnographic map of the Andean region of South America between lat. 22° S. and lat. 33° S. Then follows an account of the antiquities of the Diaguite region, otherwise known as the Calchaquie region. Lapaya, Lerme Valley, the Quebrada (ravine) del Toro, the punas of Atacama and Jujuy, the Desert of Atacama, the Quebrada de Humahuaca, the region of the Omaguacas, and the extra-Andean region of Jujuy Province are, each in turn, examined and discussed. The illustrations, well chosen and numerous, are beautifully printed.

M. W.

AFRICA

Una Gita all' Harrar. By Capitano E. A. d'Albertis. vi and 128 pp., 62 illustrations. Fratelli Treves, Editori, Milano, 1906.

A finely illustrated work on Capt. d'Albertis's journey to Harrar, once a forbidden city to all Christians, where Burton lived for a time in disguise and in peril of his life. We have had a number of good accounts of the Harrar of to-day, and this book will be numbered among the best of them. The author first gives a detailed account of the journey by rail to the environs of the city. The second half of the work is devoted to the Harrar of to-day and its peoples with a sketch of what was known of the city from the Fifteenth Century to the time of Burton's visit in 1854.

ASIA

Sikhim and Bhutan. Twenty-one Years on the Northeast Frontier, 1887–1908. By J. Claude White, C. I. E. xix and 332 pp., 41 illustrations, map and index. Large 8vo. Longmans, Green & Co., New York, 1910.

The number of Europeans who have traveled extensively in the independent Himalayan state of Bhutan may be counted on the fingers; and even the little British dependency of Sikhim has been traversed chiefly by expeditions intent upon reaching Tibet or upon exploring Mts. Kangchenjanga and Everest. Accordingly, such a book as that of Mr. White fills a genuine need. In style, arrangement, and matter the volume lies half way between the undigested journal of the globe-trotter and the finished product of the trained geographer. It belongs to that large class of valuable books written by British officials who are thoroughly acquainted with the regions which they describe, but whose official duties have precluded them from acquiring experience in literary work or in the scientific arrangement of the results of their observations.

The first 100 pages of Mr. White's book deal chiefly with Sikhim; the remainder with Bhutan. An introductory chapter is devoted to the three belts into which both countries are divided, First come the outer hills up to an

elevation of about 12,000 feet, an extremely rainy region having an annual precipitation of 200 inches or more, and a correspondingly dense growth of vegetation. The second, or central belt consists of broad flat valleys of unexplained origin, lying at an elevation of from 3,500 to 10,000 feet, and separated from one another by lofty ridges or gigantic spurs, running at right angles to the main Himalayas. Here the rainfall is less than among the outer hills, and the climate is comparatively bracing, so that the region is well populated. The third belt consists of mountainous valleys from 10,000 to 18,000 feet above sea level, cutting into or across the main range of the Himalaya which rises in many places to a height 24,000 feet or more. The few inhabitants are almost entirely shepherds.

In the main body of his book Mr. White gives some interesting reminiscences of his early experiences in Sikhim, and then describes numerous journeys back and forth across the three belts in both countries. Unfortunately he rarely discusses individual facts in their relation to the physical features of the country as a whole, and the reader is left to pick out the relationships for himself. The author succeeds, however, in giving a vivid picture of the effect produced by a tremendous rainfall in a region where the mountains are of maximum height. The result is, on the one hand, extreme difficulty of movement and corresponding isolation of the inhabitants, and, on the other hand, indescribably magnificent scenery to which Mr. White's superb illustrations do full justice. Gorges 200 feet deep with the trees from the two sides actually intermingling at the top in such fashion that a man may cross the chasm with ease, boiling rivers spanned by slender bridges of rope, bamboo ladders 200 or 300 feet long dropped down the cliffs in the attempt of the natives to procure honey, and lofty passes over glaciers which not even the yak can traverse are samples of common phenomena. Innumerable forts and Buddhist monasteries, described in minute detail, indicate that petty wars take place constantly, but that there is still need of some other means of preventing overpopulation.

All these things are well described; but the best written parts of the book are the descriptions of the marvellous vegetation, and the sympathetic account of the people. Few other countries afford such sights as roses blooming in the snow and lilies towering to a height of twelve feet. The inhabitants are by no means so attractive as their surroundings, but Mr. White pictures them in a much more favorable light than do his predecessors, from whom he quotes freely. He found both Bhutanese and Sikhimese friendly, reliable, comparatively clean and moral, and in general a pleasant people with whom to deal. He was evidently much interested in their welfare, and makes many valuable suggestions as to the proper course to be pursued by the Indian government in aiding their development.

Several official journeys across the Himalayas lead Mr. White to speculate as to how the original Bhutanese were driven to migrate from their dry home in Tibet to the wet southern side of the mountains. "All the valleys—to the north of the watershed (a region of extreme aridity in spite of its proximity to Bhutan)—appear to have at some remote period been much more densely populated than now. At every turn," he says, "I came on ruins of habitations and remains of old irrigation canals, and overcrowding may possibly account for this migration over the Himalayas into the comparatively hot valleys of Bhutan, in which no Tibetan would willingly settle, although he might be forced by circumstances to do so. . . I think there is no doubt that there must have been

considerably more rain (in the historic past than at present). . . The migration southward may be accounted for by diminished rainfall."

After completing the detailed account of his journeyings back and forth in Bhutan and Sikhim, the author devotes three chapters to an account of British relations with the former country. These are supplementary to previous brief chapters on the history of each of the two, and, although full of important material, are marred by repetition. The last chapter is a short discussion of arts and industries. The book as a whole, especially the portions dealing with Sikhim and with the people of Bhutan, is a valuable addition to our knowledge of the Himalayan states. E. H.

The Russian Road to China. By Linden Bates, Jr. ix and 391 pp., 46 illustrations and map. Houghton Mifflin Co., Boston and New York, 1910. $3.

A book of travel through Siberia to Lake Baikal, then a sledge journey across that most interesting region, Trans-baikalia, of which little has been written, though some day it will be the home of many thousands of Russian immigrants; and on across Mongolia to Peking, with chapters on the great Cossack campaigns and journeys that made Siberia a Russian possession, the development of Siberia and the story of the Mongol Hordes, and their wide territorial conquests. Urga, the center of Mongolian Buddhism and its Lamaseries is vividly depicted. A good book with wider purpose than that of superficial travel records.

The Lands of the Tamed Turk; or, The Balkan States of To-day. A narrative of travel, through Servia, Bulgaria, Montenegro, Dalmatia and the recently acquired Austrian Provinces of Bosnia and the Herzegovina; with observations of the peoples, their races, creeds, institutions and politics and of the geographical, historical and commercial aspects of the several countries. By Blair Jaekel. xiv and 295 pp., 48 photo-engravings, map and index. L. C. Page & Co., Boston, 1910. $2.50.

A traveler's graphic description of several of the Balkan countries, with bits of their history interspersed, superior photo-engravings, and a poor map.

EUROPE

Bathymetrical Survey of the Fresh-Water Lochs of Scotland. Under the direction of Sir John Murray, K.C.B., F.R.S., D.SC., etc., and Lawrence Pullar, F.R.S.E. 287 pp, maps and illustrations. Edward Stanford, London, 1908. 15s.

For twelve years (1896-08) a bathymetrical survey of the fresh-water lochs in Scotland was in progress, under the direction of Sir John Murray, Mr. Laurence Pullar, and the latter's son, the late Mr. Frederick P. Pullar. Funds for this great work were supplied by Sir John Murray and the elder Pullar. In all 562 lochs were surveyed and 18 separate papers were published in the *Geographical Journal*, between April, 1900, and January, 1908, giving many results of the investigation. With these papers were printed bathymetrical maps of 213 lochs.

The present volume contains descriptions and maps of the remainder of the Scottish lochs, sounded by the officers of the Survey, namely 349 lochs. Only

contours of depth are shown on these maps in color. The volume completes the publication of the leading results of this survey, the most notable study relating to fresh-water lakes that has yet been made.

Home Life in Ireland. By Robert Lynd. xx and 305 pp., 18 illustrations. Mills & Boon, Limited, London, 1909. 8s.

An intimate and sympathetic account of all classes of the Irish in their homes, written by a man who knows and loves his subject. He reflects in these pages, the image of the Irish and his book is full of entertainment and information. The illustrations are good. Among the twenty chapter headings are Farms and Farmers, Marriages and Matchmaking, Schools and Children, Priests and Parsons, The Irish Gentry, Politics and Gatherings, and Manners.

AUSTRALASIA AND OCEANIA

The Melanesians of British New Guinea. By C. G. Seligmann, M.D. With a chapter by F. R. Barton, C. M. G., and an appendix by E. L. Giblin. xxiv and 766 pp., 79 plates from photographs, 50 text figures, map and index. Cambridge University Press, England. G. P. Putnam's Sons, New York, 1910. $7.

One more volume, and a massive one, presents another instalment of the great contributions which the English are making to the knowledge of Torres Straits and the southern coast line of their domain in New Guinea, a region to which is now restricted, by official act, the name Papua, which formerly was loosely applied to the whole of the great island. The first detailed study in these regions was conducted in 1898 by the Cambridge Anthropological Expedition; its particular object was the islands in the straits, incidentally it included investigation into the country about the mouth of the Fly River. The Daniels expedition of 1904 was directed at the shore line of New Guinea from the head of the great gulf eastward to the southeast promontory. Dr. Seligmann served on each of these trips of exploration and in the present volume has included the results of his investigations at the earlier as well as the latter date. His method of research, certainly the form in which he presents the results of such research, seems to be a rigid compliance with some set schedule predetermined before the expeditions set out upon their essay to comprehend an unknown country. If it be really the case that a skeleton was provided to govern the distant exploration, it will account for much in the record of the result which seems mechanical, lacking in balance of interest, crowded with unimportant detail. Despite this limitation Dr. Seligmann has succeeded in making a book that is almost everywhere valuable and which at times possesses a lively interest. His scheme provides that for each spot upon which research is directed he shall secure information on a fixed order of themes. The result is tabular rather than narrative; but as it offers its information in a convenient form for the student who specializes on any one of these themes, he may find it easy to follow his theme from point to point along the whole south coast.

Dr. Seligmann follows closely in the footsteps of Haddon in identifying a dominant Melanesian element in the region under examination. At Cape Possession on the east shore of the Gulf of Papua he finds the point at which the Papuan races lose the continuity of their occupation of the soil. Eastward from that point he gives both coasts of the British Possession, that being its official

style, to the Melanesians. These again he subdivides into two groups of considerable dissimilarity, the Western Papuo-Melanesians of the continental mass of the island, and their eastern congeners, the Massim, whose foothold on New Guinea is delimited by a line drawn from Orangerie Bay on the south coast to Cape Nelson on the north, but who reach their widest development on the outlying islands and the Louisiade Archipelago. His argument is very carefully drawn on ethnographical grounds, but it should be remembered that it cannot be accepted as exclusive until the westward lying yet not infrequently included Papuans have been subjected to a much closer examination than has yet been directed upon them. The linguistic material introduces an element to which he seems to have given no consideration, one which may offer a new factor in his problem. All through the region in which he detects a Melanesian element which has sometimes overlain and at other times has expelled a prior Papuan population he has found confirmation in the identification of many words with words known to be in use in Melanesia proper.

These would be good evidence of Melanesian origin if it were distinctly known that these words are Melanesian in the instances of their occurrence in Melanesia. On the contrary the words which he identifies as Melanesian are words which in my examination of the Melanesian tongues I have shown to be loan material from the Polynesians. In my "Polynesian Wanderings" I have used the Motu language in the region under his study as one of the points determining a migration stream of Polynesians flowing out of Indonesia at the southern portal in the Arafura Sea and thence making its eastward way through Torres Straits. It is a stream which may distinctly be traced eastward through the southern Solomons, the New Hebrides, thence through Fiji to a long-deferred reunion with the other stream of migration which swept north of New Guinea and entered Melanesia through St. George's Channel and followed a northern course onward to Samoa. The people may be Melanesian in southwest New Guinea, of course remarking that at present the term Melanesian means nothing at all except a geographical convenience. But the linguistic evidence which Dr. Seligmann has amassed does not point to any language now known in the scores of languages used within the area of Melanesia. It points very positively to the Polynesian migrants who swept along these coasts at a period which I have been able to establish somewhat definitely at the beginning of the Christian era. When I was plotting the course of the Polynesian migration along the Torres Straits waterway I had to rely most largely on the Motu speech, whose coefficient of comprehensibility I have determined at 85, that is 85 per cent. of the words which it has borrowed from the Polynesian exist with so little change that they are comprehensible to the Samoan of to-day. The material which Dr. Seligmann presents from other spots on that coast falls harmoniously into confirmation of my discovery of that migration track. W. C.

GENERAL

Geographie für Handelsschulen und Realschulen. Von Dr. S. Ruge. Fünfzehnte, umgearbeitete und verbesserte Auflage. 413 pp. Dr. Seele & Co., Leipzig, 1910. Mk. 4.10.

This standard text-book by the late Dr. Ruge, is now revised by his son, Dr. W. Ruge, who associated with him Dr. E. Friedrich of the University of Leipzig, one of the leading authorities in Germany on commercial geography. The book is one of the best of the German school geographies. The allusion

in the title to commercial schools does not mean that the work is especially a commercial geography but merely that this subject is prominent among the topics of the book.

Radioactivity and Geology. By J. Jolly, M.A., Sc.D. xii and 274 pp., 8 illustrations and appendix. D. Van Nostrand Company, New York, 1909. $3.

This is largely an expansion of Prof. Joly's presidential address before the British Association in Dublin, 1908, written in less technical form. He has added, however, much material which did not appear in the address. These additions include a clear and full statement of the principles underlying this new branch of geological research, with practical details that may aid in the prosecution of further investigation. The chapter on the part which radioactivity may have played in the architecture of mountains, refers to views touched upon in the discussion at the Dublin meeting. The book, in brief, is an extended treatment of the subject of radioactivity as an influence on terrestrial history. While much of the work is admittedly speculative, there is no doubt of its importance as a contribution to geological literature.

Das Innere der Erde und der Planeten. Mathematisch-Physikalische Untersuchung. Von Heinrich Wehner. vii and 74 pp., 7 Tabelle, mit 27 Originalfiguren im Text. Craz & Gerlach (Joh. Stettner), Freiberg i. Sa., 1908. M. 2.

A closely reasoned study, mathematical and physical, of the results of investigation of the interior conditions of the Earth and other planets, with the author's own deductions. A desirable addition to the literature of Geophysics.

Paläoklimatologie. Von Dr. Wilh. R. Eckardt, Small 8vo, 141 pp. G. J. Göschen, Leipzig, 1910. 80 Pf. (Sammlung Göschen, No. 482.)

Some few months ago the present reviewer was discussing with one of his colleagues the difficulty of keeping up with the current literature in his science, and asked his colleague how he himself managed to keep in touch with the progress of *his* subject, as evidenced by the articles in current journals. "I have given up trying to do that," the latter replied. "I simply glance over a few of the papers which interest me most, and do nothing more, because I feel sure that some one will soon write a new book, or monograph, in which all the recent literature will be conveniently summarized for me." The special difficulty which the writer was then laboring under concerned the subject of geological changes of climate, the literature on which, as is well known, is widely scattered and is most of it in journals with which the climatologist has little to do. Doubtless many geologists, as well as meteorologists and climatologists, have shared in the wish that there were accessible a compact summary of this important subject, on the border-line between geology and meteorology.

Such a summary Dr. Eckardt, who is assistant at the Meteorological Observatory of Aachen, has now given us, in his welcome little volume, *Paläoklimatologie,* in the Sammlung Göschen, a series which already includes Köppen's *Klimakunde* and Trabert's *Meteorologie,* both of them excellent books on the subjects with which they deal. Dr. Eckardt gives, within less than 150 small-sized pages, a clear and compact review of geological changes of climate. We are glad, by the way, to see the word *Paläoklimatologie* used as the title

of a book. He considers the nature of the evidence and its value. He gives, in sufficient detail for ordinary use among climatologists, the story of changing climates as evidenced by the fossils, or by the rocks themselves, from pre-Carboniferous up through the Tertiary. The glacial period naturally receives special attention, and here we find, as was to be expected reference to the important work of Penck and Brückner on the Alps. With climatic conditions within historical times the author says he is not concerned, but he remarks (p. 69) that "the glacial, or rainy period gradually merges into the climate of the present time, which, apart from periodic oscillations, is as a whole to be regarded as constant as far back as the beginning of historical chronology."

As concerns Turkestan, it is stated (p. 77) that "great variations in precipitation and consequently in the water supply are evidenced, but whether periodic or non-periodic we do not yet know." The suggested causes of the geological climatic changes are reviewed, as critically as space permits. The author distinctly recognizes the complexities of the problem, and insists, as all reasonable persons must insist, upon the need of a more thorough coördination and a further study of the geological evidence of climatic changes, as well as upon the folly of expecting that any single theory will furnish the key to all paläoclimatological problems.

Dr. Eckardt gives numerous bibliographic references, mostly to German publications. The book really serves a useful purpose, and it will be welcomed by many who, like the reviewer, have been somewhat discouraged by the task of making a study of the extended literature on this subject. Dr. Eckardt writes from the standpoint of a meteorologist, and has taken special pains to consider the meteorological and climatic characteristics of each geological period.

R. DeC. W.

An Introduction to the Study of Rocks and Guide to the Museum Collection. By L. Fisher. 4th Edition. 155 pp. and index. The British Museum, London, 1909.

An informing guide to the rock collection in the British Museum. The book can be obtained only at the Museum.

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NEW MAPS

NORTH AMERICA

U. S. Geological Survey Maps

Colorado. Topographic map of San Luis Valley, Col. 1 inch=3 miles. Contour intervals, black 200 feet and brown 10 and 50 feet. 4 colors. By C. E. Siebenthal. Illustrates *Bull.* 240, "Geology and Water Resources of the San Luis Valley, Col.," same author. Washington, 1910.

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New Mexico and Arizona. (a) Map of Grand Cañon at mouth of Bright Angel Creek. 1:48,000=0.75 mile to an inch. 2 colors. By N. H. Darton. [Showing distribution of formations, especially in their relation to the topography]; (b) Geologic Map of part of Northwestern New Mexico and Northern Arizona. 1:1,000,000=15.78 miles to an inch. [13 colored symbols and white for geological formations.] Illustrates "A Reconnaissance of parts of Northwestern New Mexico and Northern Arizona," by N. H. Darton. *Bull.* 435, Washington, 1910.

New York. (a) Map of New York showing the distribution of Salina strata. 1 inch=23 miles. 3 colors. By D. H. Newland; (b) Map of Wheatland District. No scale. 4 colors; (c) Map of Oakfield and Akron districts. No scale. 3 colors. Illustrate "Gypsum Deposits of New York." By D. H. Newland and Henry Leighton. N. Y. State Museum, *Bull.* 143, Albany, 1910. [These maps illustrate the distribution and mining of gypsum in New York.]

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Montana. Fort Peck, Indian Reservation Lignite Field, p. 354; Bull Mountain Coal Field, p. 72. Milk River Coal Field, p. 98, northern part of Custer National Forest, p. 110.

Wyoming. Powder River Coal Field, p. 130, Buffalo Coal Field, p. 168; Coal Field in S. E. part of the Big Horn Basin, p. 180; Little Snake River Coal Field, p. 210; S. part of Rock Springs Coal Field, p. 240.

Colorado. South Park Coal Field, p. 314; Colorado Springs Coal Field, p. 334; Cañon City Coal Field, p. 370; Trinidad Coal Field, p. 426.

New Mexico. Carthage Coal Field, p. 456; Coal field between San Mateo and Cuba, p. 472.

U. S. Hydrographic Office Charts

Pilot charts of the South Atlantic Ocean, Dec., 1910, Jan. and Feb., 1911.
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Canada. (a) Province of Ontario, parts of Counties of Hastings, Haliburton, Renfrew and Nipissing (Haliburton sheet). 1:253,440=4 miles to an inch; (b) Geological map of portions of Hastings, Haliburton, and Peterborough counties, Ontario, 1:126,720=2 miles to an inch. 20 colored symbols. Illustrate "Geology of the Haliburton and Bancroft areas, Ontario," by Frank D. Adams and Alfred E. Barlow. *Mem.* No. 6, Canada Dept. of Mines, Geol. Surv. Branch, Ottawa, 1910. [Colors on these sheets represent geological formations.]

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Argentine. Mapa General de la Republica Argentina, 1:5,000,000=78.9 miles to an inch. 5 colors. Centenary Committee, Buenos Aires, 1910. [A good map showing communications and other economic facts. Statistical and geographical information, printed on back.]

Peru. Mapa del Departamento de Loreto, mandado levantar por el prefecto de ese Departamento. Coronel Pedro Portillo, 1 inch=17 miles. 3 colors. *Bol.* de la Soc. Géog. de Lima, Vol. 23, No. 3, Lima, 1908. [These three sheets give the southern part of the Dept. of Loreto.]

AFRICA

Tropical Africa. (a) Skeleton map of tropical Africa, showing distribution of Sleeping Sickness and *Glossina Palpalis.* 1:7,500,000=118.37 miles to an inch; (b) Skeleton map of tropical Africa, showing distribution of Tsetse flies. 1:7,500,000. Both maps in colors. Sleeping Sickness Bureau, London, 1909. [The colors show the distribution of sleeping sickness and of the flies that promote the disease as far as undoubted records have been obtained. There are probably many places infested by the disease or flies not shown here and the blanks will be filled as fast as information is obtained. These maps are examples of one phrase of the great work now being done, through European agencies, to combat this terrible disease].

Egypt. (a) Gebel Ahmar Quarry Area. 1:10,000; (b) Quarry Area east of Cairo. 1:10,000. 2 colors; (c) Atar-el-Nadi Quarry Area. 1:10,000; (d) Quarry Area south of Cairo. 1:20,000; Tura Quarry Area. 1:20,000; (e) Helwan Quarry Area. 1:10,000; Illustrate "The Building Stones of Cairo neighborhood and Upper Egypt," by W. F. Hume. Geological Survey of Egypt, Paper, No. 16, Cairo, 1910."

Egypt. (a) Map showing meteorological, river and rain gauge stations. 1:7,500,000=118.37 miles to an inch. 2 colors; (b) Magnetic Survey. Distribution of stations. 1:3,000,000=47.34 miles to an inch. Black; (c) Map of

Egypt, showing routes explored geologically and areas covered by Report. 1:3,000,000. Three colors. Illustrate "Report on the work of the Survey Dept. in 1909," Cairo, 1910.

ERITREA. Pianta della citta di Asmara con il nuovo Piano Regolatore. 1:8,000=0.1 mile to an inch. Black. Illustrates "Asmara," by Michele Checchi. *Rivista Col.* Ano. V., Serie 11. Vol. 1, Fasc. 14-15. Rome, 1910.

ASIA

CHINA. Chinkiang Harbor. 1 inch=¼ mile. 2 colors. Imperial Maritime Customs. Returns of Trade. Vol. 2, Yangtze Ports, Shanghai, 1910. [Shows surveys of 1905 and 1910 in colors, low and high water lines, etc.]

CHINA. Eastern Shantung. 1:600,000=9.4 miles to an inch. 2 colors. Imperial Maritime Customs. Returns of Trade, 1909. Vol. 1. Northern Ports. Shanghai, 1910. [Differentiates towns according to importance and shows cart and railroads, telegraph and post offices, and limits of navigation for steamers and cargo boats].

INDIA. (a) India, showing stations of observations of the magnetic scale. 1:5,000,000=78.9 miles to an inch. 2 colors; (b) Chart of India to illustrate areas in which gravity is in excess and defect. 1 inch=256 miles. 3 colors. Illustrate *Extracts* from Narrative Reports of Officers of the Survey of India, 1907-08. Calcutta, 1910.

INDIA. (a) Kangra Earthquake of 4th April, 1905. 1 in.=256 miles. [Showing the Isoscists in red]; (b) Kangra Earthquake, same date. 1 in.= 32 miles. [Showing the four highest Isoscists and approximate positions of the axial epicentra in red]; (c) Kangra Earthquake. Showing the Kangra-Kulu epicentral area. 1 inch=4 miles. 2 colors. Illustrate "The Kangra Earthquake of 4th April, 1905." By C. S. Middlemiss. *Memoirs* of the Geol. Surv. of India. Vol. xxxciii. Calcutta, 1910.

CEYLON. Ceylon. 1:1,013,760=16 miles to an inch. 4 colors. [Shows principle and minor roads, broad and narrow gauge railways, surveys, etc.]. Administrative *Reports,* 1909, Part 1, Civil. *Report* of Surveyor General, Colombo, 1909.

EUROPE

FRANCE. Bartholomew's contour motoring map of France and portions of adjoining countries. 1:1,000,000=15.78 miles to an inch. John Bartholomew & Co., Edinburgh, 1910. 10s. 6d. [12 tints of green and brown for elevations, with roads in red and distances in meters and kilometers. A first-class map for touring purposes].

FRANCE. Carte des Gisements de Coquilles comestibles de la partie des côtes de l'Ille et Vilaine et de la Manche comprise entre La Pointe du Grouin et les Roches de Bréhal. Dressée par Prof. L. Joubin. 1:46,000=0.72 mile to an inch. 5 colors. Ilustrates *Bull.* de l'Inst. Océanog., No. 174, Monaco, 1910.

FRANCE. Carte des Gisements de Coquilles comestibles de la partie des côtes de la Manche comprise entre les Roches de Bréhal, et le Hâvre de St. Germain.

Dressée par Prof. L. Joubin. 1:46,000. 5 colors. Illustrates *Bull.* de l'Inst. Océanog., No. 174, Monaco, 1910.

FRANCE. Carte des gisements de coquilles comestibles des Côtes méridionales de Bretagne comprises entre Le Plateau de Kerpape et la Pte. de Trévignon. Dressée par J. Guérin-Ganivet. 1:46,500. 5 colors. Illustrates *Bull.* de l'Institut Océanog, No. 178, Monaco, 1910.

GERMANY. Spuren der Eiszeiten in Norddeutschland. 1:3,700,000=58.3 miles to an inch. 3 colors. By H. Habenicht, *Geogr. Anzeiger,* 10 Jahrgang, 1910. [A clear delineation of the traces of the glacial period. Illustrates paper, same title and author].

ATLASES

Atlante d'Africa. 36 Tavole colorate con 200 pagine di testo di notizie geografiche, economiche e statistiche. Illustrate da 160 cartine di dettaglio e piante topografiche disegnate in base agli ultimi dati degli esplorati. Dal Prof. Arcangelo Ghisleri. Instituto Italiano d'Arti Grafiche Editore, Bergamo, 1909. L. 25. [The first instalment of this excellent atlas appeared in 1906. The work was completed in 1909; and so fast do events move in Africa, that not a few of the maps were revised to show the latest data, before the work appeared as a whole. It is the first atlas of Africa published with large descriptive text and covering practically all phases of Africa geography. The 160 small black maps illustrating the copious text, include many plans of harbors and large scale delineation of small areas. Commercial data are illustrated by diagrams. The colored maps are in the best style of Italian cartography. A similar work as well planned as this in English would be a most convenient and helpful appliance in the study of Africa.

Testo-Atlante di Geografia Storica Generale e d'Italia in particolare. Evo Contemporaneo (Parte II dell' Evo Moderno: Dal 1789 al 1909). Più di 80 Carte e Cartine in 15 Tavole con nuova carta dell' Eritrea e Somalia secondo gli ultimi trattati. 8. a Edizione. Istituto Italiano D'Arti Grafiche-Editore Bergamo, 1909. L, 2.50. [This excellent historical atlas for schools, by Prof. Arcangelo Ghisleri, carries the series of maps down to the most recent times, the plates covering the period 1788-1909. The descriptive text is an enlargement of facts given on the maps. Such a work as this helps to stimulate interest among students in the study of historical geography].

GENERAL

L'ANNÉE CARTOGRAPHIQUE. Supplément annuel, à toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Hachette et Cie, Paris, 1910. 3 frs. [Contains 3 double sheets of colored maps, with explanatory text on the reverse, relating to explorations, new surveys, boundary changes, economic development], etc. The maps, with English translation of titles, are:

AMERICA. The Transandine railroad, 1909. 1:250,000; Peruvian-Bolivian Frontier, 1909. 1:4,000,000; Progress of the railroads of Brazil, Argentine and Uruguay. 1:10,000.000.

AFRICA. Northern Mauritania, 1909. 1:6,000,000; Northwestern Rhodesia and Southern Katanga. 1:6,000,000; Regions to the northeast of Lake Chad.

1:6,000,000; Frontier region of Southwestern Uganda. 1:3,000,000; Western Sudan (hypsometrical sketch). 1:15,000,000.

ASIA. Oasis of Kouchar after the surveys of Dr. Vaillant. 1:1,250,000; Central Asia. Mongolia, Chinese Turkestan, China. Routes of the Pelliot Mission, and of Commandant de Lacoste and itinerary of Dr. Futterer. 1:7,500,000; Itineraries of Dr. J. B. Brooke in Sechuan, 1908. 1:2,500,000; Malacca Peninsula. Showing Anglo-Siamese frontier, according to the treaty of March 10, 1909. 1:7,500,000; Explorations in Cashmere (the itineraries of Dr. and Mrs. Workman, 1898-1908, and of Dr. Longstaff, 1909). 1:2,500,000; Tian-Shan, Pamir and Northern Tibet. 1:7,500,000 (Giving the itineraries of Prinz, Schultz and Zugmayer).

POLAR. The discovery of the North Pole, by Comm. Peary, 1909. 1:15,000,-000; Antarctic expedition of the *Pourquoi Pas?* commanded by Dr. Charcot. 1:40,000,000; Lands discovered by the Charcot Expedition and surveyed by Comm. Bongrain. 1:5,500,000.

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